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SOLOMON, JON

CLEONIDES: "ISAYOYI ARMONIKI"; CRITICAL EDITION, TRANSLATION, AND COMMENTARY

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CLEONIDES: ΕΙΣΑΓΩΓΗ ΑΡΜΟΝΙΚΗ;

CRITICAL EDITION, TRANSLATION, AND COMMENTARY

by

Jon Solomon

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of the University of North Carolina at
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Approved by:

Philip A. Stadter
Adviser

Calvin M. Bower
Reader

Edmund C. Brown
Reader

ABSTRACT

JON SOLOMON: Cleonides: Εἰσαγωγὴ ἁρμονική; critical edition, translation, and commentary (Under the direction of PHILIP STADTER.)

This dissertation collects forty-seven codices which contain the Εἰσαγωγὴ ἁρμονική of Cleonides and renders them, via codical analysis, into manuscript families. The result is an updated text of the Εἰσαγωγὴ ἁρμονική based on three twelfth or thirteenth-century manuscripts--Venetus Marcianus app. cl. gr. VI/3 (M), and Vaticanus gr. 2338, folios 1^{v}- 3^{v} (C) and 10^{v}- 12^{r} (P).

An introduction reviews the importance of the treatise, which preserves an excellent, systematic description of Aristoxenian musicology, and explains the need for a new text by citing the methodological and printing errors found in the previous two editions of the treatise by Jan (1895) and Menge (1916). Both Jan and Menge omitted the collation of nine manuscripts, two of which (C and P) preserve superior versions of the text. The discussion of the manuscript tradition lists the codices, and each codex is described by date, length, material, size, contents, and history. The codices are then organized into seven groups--the superior MCP and the mixed traditions of VUZQ. The interrelationships between these groups and the groups found by editors (da Rios, Düring, Winnington-Ingram) of other musicological authors (Aristoxenus, Ptolemy, Aristides Quintilianus) are then examined: MCP are also found to be the most important manuscripts for the tradition of Aristoxenus' musicological treatise.

The text is prefaced by a listing of seventeen editions and translations of the treatise--from 1497 (Valla) to 1950 (Strunk)--and the sigla for the apparatus criticus. Many of Jan's sigla have had to be abandoned or demoted. This updated text differs from Jan's in seventy-four readings, but Jan's page and line numbers have been maintained for convenience in cross-referencing. Many of these divergencies from Jan are mere corrections of printing errors or orthographical inconsistencies, but Jan's emendations have also been eliminated. An English translation follows the text.

The commentary is prefaced by a discussion of the attribution of the treatise to Cleonides, Euclid, Pappus, Zosimus, and Anonymous. There is no known musicologist named "Zosimus," and both Pappus and Euclid are known to have been Pythagorean, not Aristoxenian musicologists. Nothing is known about Cleonides, but several attempts are made at limiting the _termini post et ante quos_; of the greatest probability is that Cleonides postdates the first century B.C. His musicology is analyzed as conservatively Aristoxenian, and his style is described as terse and peripatetic; an outline of the treatise's careful organization follows. The line-by-line commentary discusses _inter alia_ textual difficulties and the translation, lists the _loci paralleli_--particularly among the other Aristoxenian authors, and concentrates on musicological exegesis, much of which is effected through modern musical notation. Because of the length and breadth of the commentary, a brief outline of the major musicological discussions in the commentary is given; an appendix discussing and affirming the Euclidean attribution of the _Sectio Canonis_ follows, and a bibliography concludes the dissertation.

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INTRODUCTION:

The Εἰσαγωγὴ ἁρμονική attributed to Cleonides offers the modern musicologist one of the most concise and uncluttered presentations of ancient Greek Aristoxenian musicological theory.[1] The works of Aristoxenus himself are fragmentary, the present editions of his work actually preserving only parts of the Ἀρχαι and Στοιχεῖα, and the works of the other Aristoxenians--Bacchius, Bryennius, Gaudentius, Alypius, and Aristides Quintilianus (along with his Neo-Platonism)--are either confused, incomplete, non-pedagogical, or Byzantine.[2] But it is not only in the twentieth century that musicologists have considered the Εἰσαγωγὴ ἁρμονική to be particularly valuable, for numerous copies of the treatise were made and studied from the twelfth to sixteenth centuries,[3] and, attached incorrectly to the corpus of the persistently influential Euclid, the treatise is said to have been read and studied by Arab scholars in the middle ages.[4] Despite the lack of familiarity most classicists and musicologists have with the treatise it has appeared in no less than seventeen editions and translations previous to this one, seven of which appeared before the eighteenth century.[5] The Εἰσαγωγὴ ἁρμονική is neither a musicological nor literary masterpiece,[6] and it is not likely ever again to achieve the popularity it once had when most of Europe thought its author was Euclid, but without this treatise our knowledge of Aristoxenian musicology, and therefore of Aristoxenus, Aristoxenians, and Greek music and musicology in general would be less complete.

The treatise is quite brief, succinct and peripatetic. In

definition after definition Cleonides presents the seven essential parts of the science of harmonics--notes, intervals, genera, systems, tones, modulation, and melodic composition--in a superbly organized fashion.[7] He digresses only occasionally, and it is perhaps this thorough organization which gave to Cleonides the popularity he enjoyed for centuries. But his terse style also forbids him from lavishing upon the text ample exegesis or a sufficient number of examples. One who was trying to learn Greek musicology by a reading of the Εἰσαγωγὴ ἁρμονική would have difficulty; the treatise is not a self-teaching guide. It presents efficiently and thoroughly all the parts and terminology of Aristoxenian musicology, but it reads more like a study guide than a textbook. Nonetheless, in conjunction with the works of the other extant Greek musicologists, it makes Aristoxenian musicology an extremely well documented discipline for modern scholars to study.

We do not know who Cleonides was; there is not a single testimonium. Perhaps for this reason the treatise was easily ascribed to various authors during the middle ages and beyond: Pappus, Euclid, and a certain Zosimus. Ultimately, attributing the Εἰσαγωγὴ ἁρμονική to Cleonides is preferable to attributing it to any of these authors or, as do several manuscripts, to Anonymous.[8] In addition to the difficulty in attribution, the original hands of our three earliest manuscripts offer no title for the treatise, but in two of them correctors have named it Εἰσαγωγὴ ἁρμονική. If this indeed is the title of the treatise, it helps us to date the work (and Cleonides?), for the word εἰσαγωγή is not known to have been used as a title before the first century B.C.; cf. <u>infra</u>, n. 1.3. Other than this, there is little evidence for dating the treatise. Since Aristoxenus is mentioned in

the treatise, it must have been composed after 300 B.C. On the other hand, numerous phrases from the treatise are employed by the fourteenth-century musical writer Bryennius. There is a spacious gap between these termini post et ante quos, which nothing in the style or vocabulary of the treatise helps to narrow; the style is entirely technical, filled with nothing but peripatetic musicological terminology, and so the works of Alypius (fourth century A.D.), Aristides Quintilianus (second century A.D.), and even Euclid (contemporary with Aristoxenus) are stylistically and lexically quite similar.[9]

Work done on Cleonides in the last century did not establish a satisfactory text. The major work was done in Jan's 1895 edition in his classic work, Musici scriptores graeci, which Menge (1916) corrected in his complete corpus of Euclid's works.[10] Menge added a translation into Latin, and Oliver Strunk translated the work into English in 1950, again using Jan's text. However, Jan omitted several codices which contain the text, especially Vaticanus gr. 2338 of the twelfth or thirteenth century which contains two early and quite reliable versions of the treatise.[11] Jan's text was also marred by numerous misprints, both in the first Teubner edition and in the 1962 Georg Olms reprint,[12] although Menge corrected such printing errors in his edition. Because of his neglect of Vaticanus gr. 2338 Jan's analysis of the manuscript tradition is seriously mistaken, as I demonstrate in the section detailing the manuscript tradition. In this dissertation I have set out a new analysis of the stemmatic relation of the manuscripts and established on that basis a new text, differing with Jan in over seventy passages.[13]

This dissertation also for the first time offers a detailed commentary on the Εἰσαγωγὴ ἁρμονική. Possevinus (1603), Herigone

(1634), Meibom (1652), Davy (1787), Ruelle (1884), Jan and Strunk offer annotations on textual and/or musicological matters, but none of these scholars have issued what by modern standards might be termed a full commentary. Manfred Fuhrmann did discuss at least the organization of the treatise in one six-page chapter of his Das systematische Lehrbuch, and Jan wrote his essay on the organization and musicology of the treatise ("Die Harmonik des Aristoxenianers Kleonides"(1870)) some twenty-five years before issuing his text, but neither offers a detailed exegesis of the treatise's terminology, manuscript tradition, text, translation, or style, nor is Jan's prosaic musicological discussion practicable for one working through the Εἰσαγωγὴ ἁρμονική as a text.

In this commentary I have tried to discuss in as much detail as appropriate 1) textual problems and the reading of the manuscripts, 2) translation of technical terms, 3) lexical summaries of technical terms, 4) exegesis of the musicology, 5) loci paralleli, particularly among the Aristoxenian authors, and 6) the organization of each passage in the treatise. Very little grammatical commentary is to be found, for the grammar of Cleonides' style[14] is extremely simple. I have complemented the musicological exegeses with charts executed via modern musical notation, for this is pedagogically the most effective way to display visually ancient Greek music. I have not discussed the loci paralleli in great detail, for this would have involved a full treatment of Aristoxenian and Pythagorean musicology, a subject much too large to be housed in a work on one author. The same limitation applies to the lexical analyses of technical terms. Because the commentary contains such a variety of subjects, I have prefaced it with a brief table of contents, and appended a "Guide to the Major Mus-

icological Discussions in the Commentary."

NOTES

1

The Aristoxenians include Aristoxenus, Cleonides, Bacchius, Gaudentius, Alypius, and to a certain extent Bryennius and Aristides Quintilianus. Editions of their works are listed infra, pp. 1f.; Bacchius, Gaudentius, and Alypius can be found in the same volume with Cleonides. For Aristoxenus himself, Rosetta da Rios, Aristoxeni elementa harmonica (Rome 1954) includes no English translation, for which the reader must turn to Henry S. Macran, ed. and trans., The Harmonics of Aristoxenus (Oxford 1902). Oliver Strunk, "Harmonic Introduction," Source Readings in Music History (New York 1950) 34-36, offers the only easily available English translation of Cleonides, while Alypius, Gaudentius, and Bacchius have not been rendered into English; Thomas J. Mathiesen is preparing a translation of Aristides Quintilianus. G. H. Jonker, ed. and trans., ΜΑΝΟΥΗΛ ΒΡΥΕΝΝΙΟΥ ΑΡΜΟΝΙΚΑ (Gronigen 1970), includes a translation of Bryennius with the text. For a summary of Aristoxenian thought, see also La Fage, Adrien de, "Aristoxène et son école," Revue et gazette musicale de Paris 24 (1857) 110-12, 156-8, 163-4. A complete bibliography of all these authors can be found in Thomas J. Mathiesen, A Bibliography of Sources for the Study of Ancient Greek Music (Hackensack 1974).

For the difference between the Aristoxenian musicologists and the Pythagoreans, see infra, p. 163. The Pythagoreans include Euclid, Nicomachus, Ptolemy, and Porphyry.

2

Bacchius' Εἰσαγωγὴ τεχνῆς μουσικῆς has organizational difficulties which have led most scholars to assume that the treatise was either written by more than one author or else derived from several sources. Bryennius is, of course, Byzantine and uses many different sources which he does not successfully blend into a consistent account. Alypius merely lists the various τόνοι (τρόποι) in the three genera, and his text is incomplete. Aristides Quintilianus moves rather quickly through the purely Aristoxenian rudiments and emphasizes other specialized or abstract matters. Gaudentius' Εἰσαγωγὴ ἁρμονική contains much material parallel to that of Cleonides' treatise, but some subjects, e.g. διάστημα, he does not discuss in any detail.

3

Of forty-seven manuscripts which contain the Εἰσαγωγὴ ἁρμονική, three belong to the twelfth or thirteenth century, two to the thirteenth, three to the fourteenth, eight to the fifteenth, and thirty-one to the sixteenth. A listing of the codices is found between pages 1 and 56.

4 For the attribution to Euclid and the evidence for an Arabic version, see infra, 162f.

5 The first being Giorgio Valla Placentino, Cleonidae harmonicum introductorium (Venice 1497). For a complete list of editions and translations, see infra, 112f.

6 The stylistic flaws are discussed infra, 175f.

7 φθόγγοι are discussed in 2.11-9.2; διαστήματα in 9.2-11.8; γένη in 11.9-15.2; συστήματα in 15.3-24.5; τόνοι in 24.6-26.18; μεταβολή in 26.19-28.18; and μελοποιία in 28.19-29.7. An outline of the treatise's exceptionally logical organization is found infra, 179f.

8 The arguments are treated in detail infra, 162f.

9 On the date of Cleonides, see infra, 168f.

10 Carl von Jan, Musici scriptores graeci (Leipzig 1895) (reprint: Hildesheim 1962) 167-207, makes numerous errors to be detailed presently. Heinrich Menge, Euclidis Phaenomena et scripta musica, vol. VIII of J. L. Heiberg and H. Menge, Euclidis Opera omnia (Leipzig 1916) 186-223, makes only minor corrections of Jan's text which he otherwise copies. Jan and Menge argue about the Euclidean attribution; other polemics on the Euclidean attribution were produced by Paul Tannery, "Inauthenticité de la 'Division du Canon' attribuée à Euclide," CRAI (1904) 439f.; Charles-Émile Ruelle, "Sur l'authenticité probable de la Division du Canon musical attribuée à Euclide," REG 19 (1906) 318-20; Sir Thomas Heath, A History of Greek Mathematics I (Oxford 1921) 444f; J. L. Heiberg, Litterargeschichtliche Studien über Euklid (Leipzig 1882) 35f; among others, for which see infra, 162f.

The two commentaries on the Εἰσαγωγὴ ἁρμονική are those of Jan, Die Harmonik des Aristoxenianers Kleonides (Landsberg 1870) 1-23, and Manfred Fuhrmann, Das systematische Lehrbuch (Göttingen 1960) 34-40. Both are brief, and the latter discusses only the organization of the treatise.

Four translations have appeared since the nineteenth century: Oscar Paul, ed., Boetius und die griechische Harmonik (Leipzig 1872) 230-44 (in German); Charles-Émile Ruelle, L'Introduction harmonique de Cleonide (Paris 1884) 1-41 (in French); Strunk (see supra, n. 1) (in English); and Menge included a Latin translation with his 1916 edition. Strunk makes an error at 26.12 where he tries unsuccessfully to reconstruct the text.

Encyclopedic entries have included H. Abert, "Kleonides," RE XI 729; Winnington-Ingram, "Greek Music" OCD^2 706 and William D. Ross, "Cleonides" OCD^2 251; G. Wille, "Kleonides" Lexicon der alten Welt 1548; and Solon Michaelides, The Music of Ancient Greece; an Encyclopaedia (London 1978) ad loc.; cf. also A. J. Neubecker, Alt-

griechische Musik; eine Einführung (Darmstadt 1977) 30.

11

These are my C(35) and P(36). Jan did not collate the following manuscripts either: Hauniensis Gl. kgl. Sml. 1871, Londiniensis Musei Britannici add. 27863, Mediolanensis Ambrosianus gr. 768 (and 135 Sup.), Upsaliensis gr. 52, Vaticanus gr. 2365, Vaticanus Rossianus gr. 977, and Vaticanus Ottobonianus gr. 372.

12

The misprints are as follows: 1.1 (apparatus) Madridensis; 2.12 ταὶ; 2.13 καὶμελω δική; 3.18 ἥ; 5.20 Εν; 10.1 ἁμιξαί; 11.3 μὲν ἐστι; 11.6 παραλλάντοντα; 11.9 δὲ; 14.20 κατὰ om.; 14.22 καὶ; 15.11 διαπέντε; 20.12 μέσην,; 24.2 ἤτοι; 26.11 μεχρὶ; 27.17 ὅσοις.

13

A complete list of the differences between my text and Jan's follows: 1.1; 1.7; 1.8; 1.11; 2.1; 2.2; 2.4; 2.6; 2.8; 2.12; 2.13; 3.4; 3.6; 3.7; 3.18; 4.4; 5.20; 6.1; 6.5; 6.8; 8.22; 9.5 and 9.6; 10.1; 10.2; 11.3; 11.6; 11.9; 12.1; 12.9; 12.15; 13.8; 14.1; 14.2; 14.20 (bis); 14.21; 14.22 (bis); 14.23; 15.1; 15.2; 15.5; 16.16-16.20; 18.13; 18.18; 19.3; 20.12; 21.6; 21.18; 22.1; 22.3; 22.5 (bis); 22.7; 23.10; 23.20; 23.22; 24.2; 24.7; 24.14; 24.15; 25.6; 26.4; 26.9 (bis); 26.10; 26.11 (bis); 26.12; 27.10; 27.15; 27.16; 27.17.

I also detected numerous misreadings in Jan's apparatus, particularly in reading $MM^{1}V$: 12.9; 17.9; 18.13; 20.8; 20.13; 20.16; 22.16; 25.2; 25.11; 27.11; 27.16; 28.2; 28.5; and 28.6. Other misreadings were made in less important manuscripts.

14

For the occasional grammatical divergencies, see infra,

THE MANUSCRIPT TRADITION:

Most of the codices which contain the Εἰσαγωγὴ ἁρμονική also contain various other ancient Greek musicological treatises. In the interest of simplicity and regularity I have written only the authors' names where the contents of each codex are listed; this type of listing occurs only with musicological treatises. The treatises to which each author's name refers are the following:

Alypius Εἰσαγωγὴ ἁρμονική (Jan, ed., pp. 367-406).

Anonymous Bellermann Anonymi Scriptio de Musica (Najock, ed.).

Aristides Quintilianus Περὶ μουσικῆς (Winnington-Ingram, ed.).

[Aristotle] Προβλήματα (Hett, ed.).

Aristoxenus Ἁρμονικὰ στοιχεῖα (da Rios, ed.).

Aristoxenus rhyth. Ῥυθμικὰ στοιχεῖα (Westphal, ed.).

Bacchius (Γέρων) Εἰσαγωγὴ τεχνῆς μουσικῆς (Jan, ed., pp. 292-316).

[Bacchius] Τῇ μουσικῇ τεχνῇ (Bellermann, ed.).

Bryennius Ἁρμονικά (Jonker, ed.).

Cleonides Εἰσαγωγὴ ἁρμονική

[Cleonides](represents the Εἰσαγωγὴ ἁρμονική without author attribution).

Euclid Κατατομὴ κανόνος (=Sectio Canonis) (Jan, ed., pp. 148-66).

[Euclid] (represents the Εἰσαγωγη ἁρμονική attributed to Euclid).

Gaudentius Ἁρμονικὴ εἰσαγωγή (Jan, ed., pp. 327-56).

Nicomachus Ἁρμονικὸν ἐγχειρίδιον (Jan, ed., pp. 235-82).

Pachymeres Ἁρμονική—μουσική (Tannery/Stephanou, eds.).

[Pappus] (represents the Εἰσαγωγὴ ἁρμονική when attributed to Pappus)

[Plutarch] Περὶ μουσικῆς (Einarson and De-Lacy, eds.).

Porphyry Εἰς τὰ ἁρμονικὰ Πτολεμαίου ὑπόμνημα (During, ed.).

Psellus Μουσικῆς σύνοψις (Heiberg, ed.).

Ptolemy Ἁρμονικά (During, ed.).

[Ptolemy] Excerpta Neapolitana (Jan, ed., pp. 411-23).

Theon Τὰ κατὰ τὸ μαθηματικὸν χρήσιμα (Hiller, ed.).

[Zosimus] (represents the Εἰσαγωγὴ ἁρμονική when attributed to Zosimus)

The editions referred to above can be found in the following bibliography. All citations here and in the commentary refer to page and line numbers of these editions. Exceptions occur where codex numbers (signified by #) or book and chapter numbers (e.g. Aristoxenus 3. 4) are given.

Bellermann = Bellermann, Johann Friedrich, ed., Anonymi scriptio de musica (Berlin 1841).

da Rios = da Rios, Rosetta, ed., Aristoxeni elementa harmonica (Rome 1954).

Düring Porph. = Düring, Ingemar, ed., Porphyrios Kommentar zur Harmonielehre des Ptolemaios (Göteborg 1932).

Düring Ptol. = Düring, Ingemar, ed., Die Harmonielehre des Klaudios Ptolemaios (Göteborg 1930).

Dupuis = Dupuis, Jean, ed., Théon de Smyrne (Paris 1892).

Einarson-De Lacy = Einarson, Benedict, and Phillip De Lacy, Plutarch Moralia XIV (Cambridge 1967).

Heiberg-Menge = Heiberg, J. L., and H. Menge, eds., Euclidis Opera omnia I-VII; Euclidis Phaenomena et scripta musica VIII (Leipzig 1883-1916)

Heiberg Ps. = Heiberg, J. L., ed., "Psellus Τῆς μουσικῆς σύνοψις ἠκριβωμένη," in Anonymi Logica et Quadrivium (Det Kgl. Danske Videnskabernes Selskab. Hist.-filol. Meddedelser 15,1) (Copenhagen 1929).

Hiller = Hiller, Eduard, ed., Theo Smyrnaeus Philosophi Platonici; Expositio rerum mathematicorum ad legendum Platonem utilium (Leipzig 1878).

Jahn = Jahn, Albert, ed., Aristides Quintilianus; De musica libri III (Berlin 1882).

Jan = Jan, Carl von, ed., Musici scriptores graeci (Leipzig 1895 and reprint: Hildesheim 1962).

Jonker = Jonker, G. H., ed., MANOYHA BPYENNIOY APMONIKA (Gronigen 1970).

Lasserre = Lasserre, Francois, ed., Plutarque De la Musique (Olten, Lausanne 1954).

Macran = Macran, Henry S., ed., The Harmonics of Aristoxenus (Oxford 1902)

Marquard = Marquard, Paul, ed., De Aristoxeni Tarentini elementis harmonicis (PhD Bonn 1863).

Najock = Najock, Dietmar, ed., Drei anonyme griechische Traktate über die Musik (Kassel 1972).

Ruelle = Ruelle, Charles-Émile, "Études sur l'Ancienne Musique Grecque," Extrait des Archives des Missions Scientifiques et Littéraires 3rd series, II (Paris 1875).

Vincent = Vincent, Alexandre Joseph Hydolphe, ed., Notice sur divers manuscrits grecs relatifs à la musique (Paris 1847).

Weil-Reinach = Weil, Henri, and Theodore Reinach, eds., Plutarque De la musique Περὶ μουσικῆς (Paris 1900).

Westphal = Westphal, Rudolf, ed., Aristoxenus von Tarent, Melik und Rhythmik des classischen Hellenentums (Leipzig 1883 and reprint: Hildesheim 1965).

Winnington-Ingram = Winnington-Ingram, R. P., ed., Aristides Quintilianus; De musica libri tres (Leipzig 1963).

The following codices are listed alphabetically by city.

Reference to "Richard" signifies:

Richard, Marcel, Répertoire des Bibliothèques et des Catalogues de Manuscrits grecs[2] (Paris 1858).

1. Berolinus Phillippicus gr. 1552 (Deutsche Staatsbibliothek Berlin/DDR Ms. Phill. 1552)

XVI century, paper, folio, 325 x 240mm., 30 11/p., 277 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 3^r- 10^r)

Contents:

f. 1^r	[Aristotle] Prob. 19.1-10
f. 3^r	[Euclid]
f. 11^r	Euclid
f. 16^r	Aristoxenus
f. 42^r	Nicomachus
f. 57^r	Bryennius
f. 147^r	Psellus De anima opiniones celebres
f. 165^r	Euclid Catoptrica
f. 174^r	Euclid Catoptrica
f. 184^r	Problema mathematicum
f. 186^r	Euclid Phaenomena
f. 208^r	Τὰ πρὸ τῶν Εὐκλείδου ὀπτικῶν
f. 226^r	Euclid Data
f. 264^r	Euclid Phaenomena
f. 266^r	Euclid Optica
f. 269^r	Euclid Data

Description taken from W. Studemund and L. Cohn, Codices ex Bibliotheca Meermanniana Phillippici graeci nunc Berolinenses I (Berlin 1890) (=Richard #214) praef. and 63-64.

This codex is written in several hands, the greater number of which belong to Bartholomeus de Zanettis of Brescia, who probably also wrote #37 (Vat. 2365); he is possibly the same as "Camillus Ven-

1. (cont'd)

etus," according to Jonker 34, who cites Vogel, M., and V. Gardthausen, Die griechischen Schreiber des MA und der Renaissance (Leipzig 1909) (=Richard #5) 49 and 227. This codex, along with the other Berlin Phillippici codices, was collected by William Pellicier, a bishop of Montpelier. It has since belonged to Claude Naulot of Burgundy, to a Parisian school, to Meermann of Batavia--whence the original name of the collection, and to Sir Thomas Phillipps (d. 1872) in England--whence the present name. It was purchased by the Deutsche Staatsbibliothek in 1887. See also Martini and Bassi in La Bibliofilia 15 (1913-1914) 41f.; A. N. L. Munby, Phillipps Studies I-V (Cambridge 1951-1960).

Jan (xxx) examined this codex in 1892 and found it to be related to U(46) and Parisinus gr. 2456 for the Εἰσαγωγὴ ἁρμονική. See also da Rios liii and Jonker 34.

2. Bononiensis gr. 2048, I (Bibliotheca Universitaria)

XVI century, paper, 377 x 260mm., 30 11/p., 770 ff. (in vols. I-V)

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 128^{r}- 134^{r})

Contents:

Vol. I:

f. 1^{r} Bryennius 1, 2

f. 112^{r} [Plutarch]

f. 128^{r} [Euclid]

f. 135^{r} Euclid

f. 140^{r} Aristoxenus 1

Vol. II:

f. 1^{r} Aristoxenus 2, 3

f. 18^{r} Alypius

f. 37^{r} Gaudentius

f. 49^{r} Nicomachus

f. 65^{r} Aristides Quintilianus

Vol. III:

f. 1^{r} Apollonius Pergaeus Conica

f. 130^{r} Serenus Antissaeus De sectione cilindri

Vol. IV:

f. 1^{r} Cleomedes De contemplatione orbium caelestium

f. 54^{r} Hero Alex. Spiritalia

f. 91^{r} Euclid Catoptrica

f. 101^{r} Euclid Optica

Vol. V:

f. 1^{r} Ptolemy

2. (cont'd)

f. 70^{r} Porphyry

Description taken from A. Olivieri and N. Festa, "Indice dei codici greci delle Biblioteche Universitaria e Communale di Bologna," Studi Italiani di Filologia Classica 3 (1895) (=Richard #218) 396-7.

The same hand is found in all five volumes, and da Rios (xlviii) believes this hand to be the same as that in Vat. 2365. The codex once belonged to the library of the Dukes of Urbino and to Johannes Cingari, and Cingari once sent them for inspection to the Abbott Mezzofanti at the library of Bologna.

For modern discussions see Jan xxxi-xxxii and da Rios xlviii, as well as Amsel, Georg, and Wilhelm Studemund, "Lectiones codicum ad scriptores de re metrica et de re musica pertinentes," Breslauer Philologische Abhandlungen I,3 (Breslau 1887). Other mentions can be found in Düring Ptol. #5, Düring Porph. #4, Lasserre #3, Winnington-Ingram #31, Weil-Reinach xlii, and Jonker 34.

3 and 4. Bononiensis gr. 2432 (olim 217) (Bibliotheca Universitaria)

XVI century, paper, folio, 282 x 222mm., 30 11/p., 96 ff.

Εἰσαγωγὴ ἁρμονική attributed to Pappus (f. 12^{v}- 17^{r}) and to Cleonides (f. 86^{r}- 92^{r})

Contents:

f. 1^{r} Alcinous (Philos.) Εἰσαγωγὴ τῶν δογμάτων Πλάτωνος

f. 11^{r} Theon (48.1-57.6)

f. 13^{r} [Pappus]

f. 17^{v} Aristoxenus

f. 40^{r} [Ptolemy]

f. 43^{r} Notes on Ptolemy's astronomical works

f. 52^{r} Barlaamus Logistica fragmenta

f. 58^{r} Georgius Gemistus De Platonicae et Aristotelicae philosophiae differentia

f. 73^{r} Alypius

f. 86^{r} Cleonides

f. 92^{r} Euclid

Description taken from A. Olivieri (see supra, p. 7) 406-408.

Da Rios (xxxiii) thinks the hand which wrote ff. 11-96 also wrote Neapolitanus gr. III. C. 2 (ff. 1-50). A different hand wrote ff. 1-10 here.

See also Jan xxxii, xc-xci and da Rios xxxiii-xxxiv. Karl Friedrich Hermann, Platonis dialogi VI (Leipzig 1853) xviii, omits mention of this codex though he offers (152f.) an edition of Alcinous' treatise. For the Theon fragment, see infra, codex 11 and Hiller vii.

5. Cantabrigensis gr. 1464 (Gg. II. 34) (University Library)

Late XV or early XVI century, paper, folio min., 29 11/p., 16 ff.

Εἰσαγωγὴ ἁρμονική attributed to Cleonides (f. 1^{v}- 8^{v})

Contents:

f. 1^{v} Cleonides

f. 8^{v} Euclid

Description taken from Churchill Babington, ed., A Catalogue of the MSS Preserved in the Library of the University of Cambridge (Cambridge 1858) (=Richard #261) 63, which cites only Gregorius' edition of the treatises.

See also Jan xci.

6. Escorialensis gr. Φ-II-5

XVI century, paper, folio, 30 11/p., 188 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 1^{v}- 5^{v})

Contents:

f. 1^{v} [Euclid]

f. 5^{v} Euclid

f. 9^{v} Nicomachus

f. 23^{v} [Plutarch]

f. 39^{r} Aristoxenus

f. 62^{r} Alypius

f. 77^{r} Gaudentius

f. 93^{v} Bryennius

Description taken from E. Miller, Catalogue des Manuscrits Grecs de la Bibliothèque de l'Escurial (Paris 1848) (=Richard #343) 155 (#199), who cites Fabricius and Plüer ("Alisius" for "Alypius"). For other catalogues, see Charles Graux, Essai sur les origines du fonds grec de l'Escurial (Bibliothèque de l'École des Hautes Études. Sciences philologiques et historiques XLVI) (Paris 1880) (=Richard #346) 152 and 492; Gregorio de Andrés, Catálogo de los Códices Griegos de la Real Biblioteca de El Escorial II (Madrid 1965) (cf. Richard #346) 31-32; and G. Haenel, Catalogi librorum mss in bibliothecis Galliae, Helvetiae, Belgii, Britanniae M., Hispaniae, Lusitaniae asservantur (Leipzig 1830) 929.

Brief mentions can be found in da Rios lii, Jan xxxiv, and Jonker 35 (#5).

7. Escorialensis X-I-12

XVI century, paper, folio, 461 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 163^{v}-171^{r})

Contents:

f. 1^{v} Aristides Quintilianus

f. 57^{r} Bryennius

f. 163^{v} [Euclid]

f. 171^{r} Euclid

f. 175^{v} Aristoxenus

f. 212^{r} Gaudentius

f. 229^{v} Nicomachus

f. 242^{rr} Nicomachus

f. 256^{v} Ptolemy

f. 330^{v} Porphyry

Description taken from Miller (see supra, p. 10) 295-6 (#351). See also Andrés (see supra, p. 10) #354, pp. 251-3.

This codex once belonged to the library of Hurtado de Mendoza.

Jan (xxxiv) thinks the readings here closely resemble Meibom's Oxford manuscript, while Düring (Porph. #9) sees a filial relationship with his #82 (U(45)). Both Jan and da Rios (lii) omit mention of the Sectio Canonis. Brief mention can also be found in Winnington-Ingram #35, Ruelle 31-33, 523, and Düring Ptol. xii (#10).

8 and 9. Florentinus Riccardianus gr. 41 (K. II. 2)

XVI century, paper, 280 x 210mm., 29 11/p., 177 ff.

Εἰσαγωγὴ ἁρμονική attributed to no one (f. 29^{r}-35^{r}) and to Cleonides (f. 68^{r}- 74^{v})

Contents:

f. 1^{v} Theophrastus Characteres 16-23

f. 3^{v} Theophrastus Characteres 1-15

f. 8^{v} Quaestiones rhetoricae

f. 12^{r} M. Planudes Carmen

f. 12^{v} Opera medica

f. 17^{v} Gaudentius

f. 26^{r} Theon

f. 29^{r} [Cleonides]

f. 35^{v} Aristoxenus

f. 58^{v} [Ptolemy]

f. 68^{r} Cleonides

f. 89^{v} Aristides Quintilianus

f. 146^{v} Anonymous Bellermann

f. 155^{v} Heracleitus Adversus Homeri de tractores allegoriae physicae

Description taken from G. Vitelli, "Indice de' codici greci Riccardiani, Magliabechiani e Marucelliani," Studi Italiani di Filologia Classica 2 (1899) (=Richard #355) 498-500. See also J. Lamius, Catalogus codicum manuscriptorum qui in Bibliotheca Riccardiana Florentiae adservantur (Livorno 1756) 41; and C. Samberger, Catalogi codicum graecorum qui in minoribus bibliothecis Italicis asservantur (Leipzig 1965) 162f.

8 and 9. (cont'd)

Da Rios (xliv) sees three hands in the codex--f. 1-2; 3-12 and 156-77; and 13-154. See also Najock 21-22, Jan xxxvii (#36), and Winnington-Ingram #18.

10. Hamburgensis cod. phil. 109 (Staats-und Universitatsbibliothek)

XVI or XVII century, paper, 4^{o} min.

Εἰσαγωγὴ ἁρμονική attributed to Pappus

This manuscript has been missing since World War II, and correspondence from Eva Horváth, librarian of the Handschriftenabteilung of the Staats-und Universitatsbibliothek--Hamburg, assures me that the codex has indeed been lost.

The Εἰσαγωγὴ ἁρμονική was located in part 6 of six parts, and it was attributed to Pappus. According to Jan (xxxvii-xl) the codex also included the musical treatises of Bacchius, Aristides Quintilianus, Gaudentius, and Theon, as well as Mesomedes' first hymn. R. Münzel, Philologica Hamburgensia für die Mitgleider der 48. Versammlung deutscher Philologen und Schulmänner (Hamburg 1905) 41 (#227), refers to Aristides Quintilianus (cod. phil. 109), Theon (cod. phil. 95), Bacchius (cod. phil. 110), and Gaudentius (cod. phil. 111). See also Winnington-Ingram #10a.

11. Hauniensis Gl. kgl. Sml. 1871 (Kongelige Bibliothek)

XVI century, paper, quarto, 36 ll/p., 32 ff.

Εἰσαγωγὴ ἁρμονική attributed to no one (f. 16^r- 22^r)

Contents:

f. 1^r Aristides Quintilianus

f. 12^r Theon (46.20-57.6)

f. 16^r [Cleonides]

f. 23^r Gaudentius

Description taken from Charles Graux, "Rapport sur les manuscrits grecs de Copenhague. Notices sommaires des manuscrits grecs de la grande Bibliothèque royale de Copenhague," Archives des missions scientifiques et littéraires 3rd series 6 (1880) (=Richard #302), which can also be found in Charles-Émile Ruelle, Les articles originaux publiés dans différents recueils par Charles Graux (Paris 1893) 235-336.

This codex was given as a gift to Frederic Rostgaard by a professor (Arna Magnaea); it was acquired in 1726 by Count Danneskjold and in 1732 by the Royal Library.

The treatise of Aristides Quintilianus extends only to 42.11(δίεσις); cf. Jahn lvii and Winnington-Ingram #10. For the fragment of Theon, cf. supra, p. 8.

12. Lipsiensis gr. 25 (Staatsbibliothek) (L)

XV (or XVI) century, paper, 173 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 4^{v}- 9^{a})

Contents:

f.	4^{v}	[Euclid]
f.	9^{v}	Euclid
f.	13^{v}	Aristoxenus
f.	33^{r}	Alypius
f.	45^{v}	Gaudentius
f.	54^{v}	Nicomachus
f.	66^{r}	Aristides Quintilianus
f.	111^{v}	Bryennius 1, 2

Description taken from G. R. Naumann, Catalogus librorum manuscriptorum qui in Bibliotheca Senatoria civitatis Lipsiensis asservantur (Leipzig 1838) (= Richard # 482) 9-10.

Jonker (36) discusses the date of the codex, citing Koster and Holwerda as the first to give it a sixteenth-century date. Jonker cites f. 163; Carl Ferdinand Becker, Systematische-chronol gische Darstellung der musikalischen Litteratur (Leipzig 1836) col. 542; and C. M. Briquet, Les Filigranes^{2} (Leipzig 1923) #6389, 6291, 6928-6300 (A.D. 1511-1556).

Brief mention is made of this codex by Jan xl-xli, Westphal II.xc and xcvi, da Rios xxxv, and Winnington-Ingram (#20) who mentions that this codex was also examined by Bellermann and J. Caesar.

13. Londiniensis Musei Britannici add. 27863

XVI century, paper, folio, 30 ll/p., 115 ff.

Εἰσαγωγὴ ἁρμονική attributed to Cleonides (f. 108^r- 114^r)

Contents:

f. 3^v [Adrastus] (=Bryennius)

f. 108^r Cleonides

f. 114^r Euclid

Description taken from the Catalogue of Additions to the Manuscripts in the British Museum in the Years MDCCCLIV-MDCCCLXXV II (London 1877) (=Richard #543) 355 and 366, although the Sectio Canonis is not distinguished from the Εἰσαγωγὴ ἁρμονική in this catalogue. See also Thomas J. Mathiesen, "Towards a Corpus of Ancient Greek Music Theory; a New Catalogue Raisonne Planned for RISM," Fontes Artis Musicae 25 (1978) 119-34; M. Richard, Inventaire des manuscrits grecs du British Museum I (Paris 1952) (=Richard #528) 48, and Henri Omont, "Notes sur les mss grecs du British Museum;" Bibliothèque de l'École des Chartres XLV (Paris 1884) 336.

This codex was written in c. A.D. 1550 by Christopher Auer (or Awer), and it was acquired by the British Museum in 1868.

Bryennius' three books on harmonics are listed here as "Adrasti Peripatetici [potius Manuelis Bryennii] Harmonicorum libri tres." See Jonker 36 (#15), and Vogel-Gardthausen (see supra, p. 5) 423f.

14. Lugdunensis Perizonianus F. 41 (olim Lugdunensis 135) (Universiteits Bibliotheek)

XVI century, paper, folio, 260 x 130mm., 23-36 ll/p., 16 ff.

Εἰσαγωγὴ ἁρμονική attributed to Anonymous (f. 1^{v}- 13^{v})

Contents:

f. 1^{v} Anonymous (=Cleonides)

f. 13^{v} Aristides Quintilianus 1.12

Description taken from K. A. Meyer, Codices Perizoniani (Leiden 1946) (=Richard #521) 37, who discusses all thirty manuscripts in the Perizonianus collection. Earlier catalogues include P. C. Molhuysen, Catalogus codicum manuscriptorum Bibliothecae Universitatis Leidensis I (Leiden 1910) (=Richard #519) v; and Bibliothecae Academiae Lugduno-Batavae; Catalogus deel XIV Inventaris van de Handschriften (Leiden 1932) (=Richard #515), which lists all the earlier catalogues. Cf. Jac. Geel, Catalogus librorum manuscriptorum qui inde ab anno 1741 Bibliothecae Lugduno-Batavae accesserunt I (Leyden 1852) (=Richard #518) 40.

This codex was written by Bonaventura Vulcanius; the codices Vulcaniani are described in Molhuysen. On folio 1^{v} there is mention of P. Burmann; the Universiteits Bibliotheek has four Codices Burmanniani. Cf. Vogel-Gardthausen (see supra, p. 5) 436.

Meibom used this codex for his edition (1652); see his Aristides 208, and the praef. to Euclid. Brief mention is made of this codex also by Jan xliii (#55), da Rios xli, and Winnington-Ingram #61.

15. Matritensis gr. 4678 (olim N. 48) (Biblioteca nacional) (Z)

XIV century, paper, quarto, 30 11/p., 146 ff.

Εἰσαγωγὴ ἁρμονική attributed to Zosimus (f. 137^{r}- 142^{r})

Contents:

f. 2^{r} Nicomachus

f. 58^{r} Diophantus Alexandrinus Ἀριθμητικά

f. 130^{v} Diophantus Alexandrinus Περὶ πολυγώνων ἀριθμῶν

f. 137^{r} [Zosimus]

f. 142^{r} Euclid

Description taken from J. Iriarte, Regiae Bibliothecae Matritensis codices graeci manuscripti I (Madrid 1769) (=Richard #568) 136. See also Jan xl-xliv (#56) and Ruelle 575.

16. Mediolanensis Ambrosianus gr. 768 (and 135 sup.)

XVI century, paper, folio, 220 x 150mm., 28-33 ll/p., 24 ff.

Εἰσαγωγὴ ἁρμονική attributed to Anonymous (f. 1^{r}- 8^{v})

Contents:

f. 1^{r} Anonymous (=Cleonides)

f. 9^{v} Grammatical Notes

Description taken from Emidio Martini and D. Bassi, Catalogus codicum graecorum Bibliothecae Ambrosianae II (Milan 1906) (=Richard #601) 87.

Folio 9 contains the following information: "Romae 13 Sept 1567; in domo Card. gravellani." The end of the Εἰσαγωγὴ ἁρμονική continues with the Aristides Quintilianus insert (see infra, p.) which follows f. 9.17 and with some grammatical notes (f. 10) which do not at all pertain to the Εἰσαγωγή. The rest of the codex is blank. The initial folio of the codex incorrectly labels the work, "Nicomachi Harmonica Enchiridion"; the text itself is attributed to "Anonymous."

17. Monacensis gr. 104 (olim Bibl. Elect. Bavar. 175) (Bayerische Staatsbibliothek)

XVI century, paper, folio, 30 ll/p., 383 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 157^{v}- 164^{r})

Contents:

f. 1^{r} Aristides Quintilianus

f. 55^{v} Bryennius

f. 157^{v} [Euclid]

f. 164^{r} Euclid

f. 168^{v} Aristoxenus

f. 195^{v} Alypius

f. 212^{v} Gaudentius

f. 224^{v} Nicomachus

f. 239^{v} Συνοπτικὸν σύνταγμα φιλοσοφίας

f. 262^{v} Περὶ ψυχῆς διαίρεσις καὶ σύνοψις κατὰ Πλωτείνου

f. 281^{v} Photius Ἐκ τῶν Ἀμφιλοχίων κεφ. $\overline{\lambda\eta}$

f. 282^{v} Theodorus Abucara Διάλεξις αἱρετικοῦ πρὸς ὀρθόδοξον, περὶ θεοῦ καὶ θεότητος

f. 283^{r} Theodorus Περὶ θεοῦ ὀνομάτων, et al.

f. 289^{r} Ἡ κοινὴ ὁρμασία ἡ, ἀπὸ τῆς μουσικῆς μεταβληθεῖσα

f. 289^{v} Μουσικοῦ κανόνος κατατομή

f. 293^{v} Hephaestion (Alex.) Ἐγχειρίδιον περὶ μέτρων καὶ πρώτων περὶ βραχείας συλλαβῆς

f. 335^{v} Demetrius Triclinius Ἐγχειρίδιον περὶ μέτρων

f. 337^{v} Anonymous (or Aelian) Στρατηγικῶν τάξεων διάταξις

f. 351^{v} Maximus Planudes Ψηφοφορία κατ' ἰνδοὺς ἡ λεγομένη μεγάλη

Description taken from I. Hardt, Catalogus codicum manuscriptorum Regiae Bibliothecae Bauaricae I (Munich 1806) (=Richard #622) 551, who prints incorrectly that there are 583 folios in the codex.

This codex was written by Francisco Cladius of Crete in 1552, Venice.

The material up to folio 239 resembles very closely that in codex 46(U), a fact which lead da Rios (xli) to see similarities between the two codices; but most of the U-type codices have similar contents.

See also Vogel-Gardthausen (see supra, p. 5) 424, Jahn liii-liii, Jan xlvi-xlviii, Winnington-Ingram #22, and da Rios xl-xli.

18 and 19. Neapolitanus gr. 260 (olim III. C. 2) (N)

XV century, paper, quarto, 287 x 210mm., 30 ll/p., 99 ff.

Εἰσαγωγὴ ἁρμονική attributed to Anonymous (f. 16^r- 21^r)

and to Cleonides (f. 55^r- 63^v)

Contents:

f. 1^r Hippocrates De veinis

f. 6^r Gaudentius

f. 13^v Theon

f. 16^r Anonymous (=Cleonides)

f. 21^r Aristoxenus

f. 41^v [Ptolemy]

f. 45^v Περὶ τῶν ὀπτικῶν ὑποθέσεων

f. 46^v Damian Τοῦ Ἡλιοδώρου Λαρισσαῖον κεφάλαια τῶν ὀπτικῶν ὑποθέσεων

f. 55^r Cleonides

f. 63^v Euclid

f. 71^r Barlaamus Λογιστικὴ (προοίμιον)

f. 83^r Barlaamus Ἀριθμητικὴ ὑπόδειξις

f. 89^r Barlaamus Περὶ τοῦ πῶς δεῖ ἐκ μαθηματικῆς

Description taken from S. Cyrillus, Codices graeci manuscripti Regiae Bibliothecae Borbonicae descripti atque illustrati II (Naples 1832) (=Richard #623) 341f.

Da Rios (xxxii-xxxiii) believes ff. 55-99 were written by George Tzangaropulo and compares the hand of ff. 1-50 with that which wrote Bononiensis gr. 2432 (ff. 11-96), q.v. This codex was used and probably owned by Giorgio Valla (Placentino), who prepared the editio princeps; see Mathiesen (supra, p. 17) 120. After Valla's death(1500) the

18 and 19. (cont'd)

codex fell into the hands of Albertus Pius (1475-1550).

Jan (li-liv) designates this codex as N, but there are two different versions of the Εἰσαγωγὴ ἁρμονική here.

20. Oxoniensis Bodleianus Baroccianus gr. 41

XV century, paper, quarto min., 20 ll/p., 314 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 1^{v}- 13^{v})

Contents:

f. 1^{v} [Euclid]

f. 14^{r} Euclid

f. 21^{r} Aristoxenus

f. 70^{v} Alypius

f. 100^{v} Gaudentius

f. 121^{v} Nicomachus

f. 147^{v} Porphyry

Description taken from Henry O. Coxe, Catalogi codicum manuscriptorum Bibliothecae Bodleianae I (Oxford 1853) (=Richard #651) col. 59, although Coxe does not distinguish the Sectio Canonis from the Εἰσαγωγὴ ἁρμονική.

Gerhard Langbain collated this codex; cf. Meibom praef. (Coxe lists thirty manuscripts Langbainii and fifty-four Seldenii). See also Jan lviii, Düring Porph. #34, and da Rios #34, who omits Euclid from her listing of the contents.

21. Parisinus gr. 2456 (olim Fontanebl. reg. 2179)

XVI century, paper, folio, 335 x 230mm., 30 11/p., 488 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 197^{v}- 205^{v})

Contents:

f. 1^{v} Aristides Quintilianus

f. 63^{r} Bryennius

f. 181^{r} [Plutarch]

f. 197^{v} [Euclid]

f. 206^{r} Euclid

f. 209^{v} Aristoxenus

f. 239^{v} Alypius

f. 258^{r} Gaudentius

f. 271^{r} Nicomachus

f. 285^{v} Ptolemy

f. 353^{v} Porphyry

f. 477^{r} Bacchius

Description taken from Henri Omont, Inventaire sommaire des manuscrits grecs de la Bibliothèque nationale et des autres bibliothèques de Paris et des Départments II (Paris 1886) (=Richard #58) 264; cf. Henri Omont, Catalogues des mss grecs de Fontainbleau (Paris 1889) 129f., #380 ann.

This codex was written by either Michaele Damascenus or Valerianus Albinus.

See also Vogel-Gardthausen (supra, p. 5) 310, 311, and 371; Jan lxi-lxii (#11½); da Rios xxxvi who omits Euclid; Ruelle apud Westphal II xcix; Lasserre #24; Weil-Reinach xl; Düring Ptol. xxix (#46); Jonker 39 (#32); Düring Porph. #43; Winnington-Ingram #32; and A. Gas-

21. (cont'd)

toué, Catalogue des manuscrits de musique Byzantine de la Bibliothèque nationale de Paris et des bibliothèques publiques de France (Paris 1907) (=Richard #673) 87.

22. Parisinus gr. 2457 (olim Teller Rem.-Reg. 2179,3)

XVI century, paper, folio min., 345 x 235mm., 30 ll/p., 775 pp.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (pp. 321-32)

Contents:

p. 1 Aristides Quintilianus

p. 101 Bryennius

p. 295 [Plutarch]

p. 321 [Euclid]

p. 333 Euclid

p. 340 Aristoxenus

p. 384 Alypius

p. 414 Gaudentius

p. 435 Nicomachus

p. 460 Ptolemy

p. 567 Porphyry

Description taken from Omont (supra, p. 25) II 264-5; cf. IV xxxi and Omont, Revue des Bibliothèques 2 (1892) 153.

This codex was written by Angelo Vergetio in 1537.

See also brief mentions in Jan lxii (#115) who omits Gaudentius, Winnington-Ingram #30, Düring Ptol. xxix-xxx (#47), da Rios xxxvi-xxxvii, Lasserre #25, Weil-Reinach xl, Gastoué (supra, p. 26), Düring Porph. #44, Ruelle apud Westphal II xcix-c, and Vogel-Gardthausen (supra, p. 5) 2.

23 and 24. Parisinus gr. 2460 (olim Teller Rem.-Reg. 2179,2)

XVI century, paper, folio, 320 x 215mm., 31 ll/p., 218 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 40^{r}- 45^{v}) and to Pappus (f. 52^{v}- 57^{v})

Contents:

f. 1^{r}	Alypius
f. 14^{r}	Gaudentius
f. 23^{v}	Anonymous Bellermann
f. 31^{v}	Bacchius
f. 35^{v}	[Bacchius]
f. 40^{r}	[Euclid]
f. 46^{r}	Euclid
f. 49^{v}	Theon
f. 52^{v}	[Pappus]
f. 59^{r}	Aristoxenus
f. 81^{v}	Nicomachus
f. 96^{v}	Aristides Quintilianus
f. 144^{v}	Bryennius 1, 2
f. 205^{v}	Notae Latinae in Bryennium

Description taken from Omont (see supra, p. 25) II 265.

The notes to Bryennius (ff. 205^{v}- 218^{r}) were written by Petrus de Fermat; cf. J. L. Heiberg and H. G. Zeuthen, eds., Paul Tannery, Mémoires Scientifiques (Toulouse, Paris 1912) 140f., and P. Tannery, ed., Oeuvres de Fermat I (Paris 1891) xviii, 374, and 394-410.

The fifth treatise is attributed to "Dionysius" by Jan, "Anonymous" by Omont, and "Pseudo-Bacchius" by Najock. Editions can be found in Bellermann 101f. and Vincent 64-72.

23 and 24. (cont'd)

Brief mention can be found in Jan lxiii-lxiv (#118), da Rios xliii, Ruelle apud Westphal II c-ci, Gastoué (supra, p. 26) 87, Winnington-Ingram #21, and Najock 28-29, who omits the first Εἰσαγωγὴ ἁρμονική (attributed to Euclid).

25. Parisinus gr. 2535 (olim Baluze.-Reg. 2403)

XVI century, paper, 8^{o}, 26-27 ll/p., 147 ff.

Εἰσαγωγὴ ἁρμονική attributed to Cleonides (f. 1^{r}- 10^{r})

Contents:

f. 1^{r}	Cleonides
f. 10^{r}	Euclid
f. 12^{v}	Pappus Mechanicorum problematum libri 1, 2
f. 19^{v}	Fragmenta mathematica harmonica et astronomica
f. 43^{v}	Hero Isagoge geometrica (pars)
f. 46^{v}	Nicolas Artavasda Rhabdus Arithmeticae fragmentum
f. 47^{v}	Anonymous Grammatica ad Lazarum amicum
f. 108^{v}	Joannes Chrysostomus Homilia in illud: Cum vos persecuti fuerint homines
f. 112^{v}	Olympiodorus In Platonis Philebum et Phaedonem commentarii fragmenta
f. 128^{v}	Libanius Oratio, Demosthenis nomine, adversus Aeschinem

Description taken from Omont (See supra, p. 25) II 279-80, though Omont neglects to list the Sectio Canonis.

This is one of the few codices in which the Εἰσαγωγὴ ἁρμονική (with Sectio Canonis) is the sole musicological treatise (but cf. ff. 19^{v}- 43^{r}). See Jan lxv-lxvii (#129) and Bernard de Montfaucon, Bibliotheca bibliothecarum manuscriptorum nova II (Paris 1739) 1303 E.

26. Parisinus Supplementarius gr. 449 (olim R. B. 2502, 2839)

XV century, paper, 280 x 225mm., 35-37 ll/p., 300 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 294^{v}- 297^{v})

Contents:

f. 4^{v} Ptolemy

f. 119^{v} Porphyry

f. 175^{r} Pappus Commentarius in Harmonica Ptolemaei

f. 232^{v} Thrasyllus Sectio Canonis (=Theon 35)

f. 239^{v} Gaudentius

f. 250^{v} Aristoxenus

f. 279^{r} [Ptolemy]

f. 280^{v} Alypius

f. 294^{v} [Euclid]

Description taken from Omont (see supra, p. 25) III (1898) 263-4 or Supp. 51.

This codex was bought by Maurice Bressi in 1839.

For Theon, see Hiller 87.4 and Dupuis 142. Brief mention is made in Jan lxviii-lxix (#143), Ruelle apud Westphal ci-cii, Düring Ptol. xxxiii (#57), Düring Porph. #49, Vincent 292, and da Rios xxxiv.

27. Upsaliensis gr. 52 (Bibliothèque de l'Université) (S)

XVI century, paper, 36-38 ll/p., 774 pp.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (pp. 7-17)

Contents:

p. 1 Psellus

p. 7 [Euclid]

p. 19 Euclid

p. 37 Bacchius

p. 85 Alypius

p. 125 Aristoxenus

p. 181 Aristides Quintilianus

p. 311 Bryennius

p. 555 Porphyry

Description taken from Jonker 41 (#44), who could work only from the index sent to him by Gustaf Holmgren of the Uppsala Bibliothèque de l'Université. Of little help is Charles Graux and A. Martin, "Notices sommaires des manuscrits grecs en Suède," Archives des Missions scientifiques et littéraires 3rd series, 15 (1889) (=Richard #86) 355, which da Rios (xliii) used (with pp. 57f.).

This codex was written shortly before 1590 by Sebastian Mieg in Strasbourg; cf. E. Rosengren, De origine Aristoxeni Elementorum Harmonicorum codice Upsaliensis disputatio (Hernosand 1888) 23.

Both Winnington-Ingram and Düring (Porph.) omit any mention of this codex, nor did Jan use it.

28 and 29. Vaticanus gr. 191 (olim 199) (V and W)

XIII or XIV century, paper, folio, 365 x 235mm., 40-43 ll/p., 397 ff.

Εἰσαγωγὴ ἁρμονική attributed to no one (f. 291^{v}- 295^{r}) and to no one (f. 392^{v}- 395^{r})

Contents:

f. 2^{r} Euclid Catoptrica

f. 4^{v} Euclid Phaenomena

f. 12^{r} Euclid Optica

f. 18^{r} Euclid Data

f. 29^{r} Marinus Commentarium in Data

f. 31^{r} Theodosius Sphaerica

f. 46^{r} Theodosius Varia scripta

f. 59^{r} Aristarchus De magnitudinibus et distantiis solis et lunae

f. 64^{r} Mathematica et astronomica opera varia

f. 286^{v} Gaudentius

f. 291^{v} [Cleonides]

f. 295^{r} Euclid

f. 296^{v} Aristoxenus

f. 308^{v} Alypius

f. 313^{v} Aristoxenus rhyth.

f. 319^{v} Ptolemy

f. 360^{v} Diophantus Arithmetica

f. 389^{v} Diophantus De polygonis num. lib.

f. 392^{v} [Cleonides]

f. 395^{r} Euclid

28 and 29. (cont'd)

f. 396^{v} Nomina eorum qui leges xii tabulas tulerunt et de origine Constantinopolis

Description taken from Johannes Mercati and Pius Franchi de' Cavalieri, Codices Vaticani graeci I (Rome 1923) (=Richard #719) 220-27.

Da Rios (xxx-xxxi) distinguished three different hands in this codex. Other catalogues contain this codex as well: Karl Müller, "Codex Vaticanus 191," Hermes 15 (1880) 300f.; G. Kroll and A. Olivieri, Catalogus codicum astrologorum graecorum II (Brussels 1900) (=Richard #19) 3-23; Vettius Valens ixf.; Heiberg-Menge VI xiii and VIII xxiv; Ernst Maass, Analecta Eratosthenea (Berlin 1883) and Adolf G. Kiessling and U. von Wilamowitz, Philologische Untersuchungen VI (Berlin 1880-81) 10f.; Gustav Friedrich Constantin Parthey, Monatsberichte der Berlin Akademie (1863) 374f; and Giuseppe Spezi, Memoria di un codice Vaticano (Rome 1865).

The codex is also listed in Düring Ptol. xxxv (#64), Marquard xv-xxiii, and Jan xxiv-xxviii (#3) who lists the folios of the second Εἰσαγωγὴ ἁρμονική incorrectly.

30. Vaticanus gr. 221 (olim 203)

XVI century, paper, 330 x 220mm., 36 ll/p., 356 pp.

Εἰσαγωγὴ ἁρμονική attributed to no one (pp. 265-74)

Contents:

p. 1 Aristoxenus

p. 40 Ptolemy

p. 153 Porphyry

p. 225 [Plutarch]

p. 249 Theon

p. 265 [Cleonides]

p. 274 Euclid

p. 281 Gaudentius

p. 297 Alypius

p. 319 Bacchius

p. 327 [Bacchius]

p. 331 Anonymous Bellermann

Description taken from Mercati-Cavalieri (see supra, p. 35) 288-89.

This codex was written by Johannes Honorius between 1535 and 1549; cf. infra, codd. 38-39 and 43.

Brief mention can be found in Jan lxxii-lxxiii (#150) who omits mention of the Anonymous Bellermann, Heiberg-Menge VIII xlvi, Hiller vii, Dupuis x, Najock 29-30, da Rios xxxviii-xxxix, Einarson-De Lacy ix, Düring Ptol. xxxvi-xxxvii, and Düring Porph. #54.

31. Vaticanus gr. 671

XIV century, cotton, 251 ff.

Εἰσαγωγὴ ἁρμονική attributed to Pappus (?)

Jan (lxxiii (#151)) lists this codex as one which contains a version of the Εἰσαγωγὴ ἁρμονική attributed to Pappus, but Robert DeVreesse (Codices Vaticani graeci III (Rome 1950) (=Richard #721) 117-122) disconcertingly mentions nothing of a musicological treatise attributed to Pappus or Cleonides. His detailed list of treatises contains numerous tracts by Psellus, various treatises by Aristotle, Philo Judaeus, and even Euclid, but no mention of our Εἰσαγωγὴ ἁρμονική is made. There is one musicological treatise, Johannus Pediasmus' Observationes in musicam, which can be found in Vincent 290-314. On the other hand, Jan does not at all mention Pediasmus' treatise, Psellus', or any other treatise in Vaticanus gr. 671 other than the Εἰσαγωγὴ ἁρμονική. He cites Montfaucon (see supra, p. 31) 116, but I find nothing of value there.

Complicating the discrepancy is the poor condition of the codex. Much of it is water damaged, and blocks of folios are absolutely illegible. Jan examined, it seems, the codex some sixty years before DeVreesse, and perhaps he found something that DeVreesse could not. Lastly, none of the books listed in Paul Canart and Vittorio Peri, Sussidi bibliographici per i manoscritti greci della Biblioteca Vaticana (Vatican 1970) 576, seem to help, for they discuss only the treatises by Psellus or Pediasmus.

Ultimately, the version of the Εἰσαγωγὴ ἁρμονική in this codex must be discarded as illegible.

32. Vaticanus gr. 1033

XVI century, paper, 82 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 57^{r})

Contents:

f. 1^{r} [Timaeus of Locris] Περὶ ψυχᾶς κόσμου καὶ φύσιος

f. 15^{r} Plutarch Ἐπιτομὴ τοῦ περὶ τῆς ἐν τῷ τιμαίῳ ψυχογονίας

f. 25^{r} [Timaeus] De mundi anima (Latin text)

f. 41^{r} Plutarch In Timaeo De anima (Latin text)

f. 44^{v} Franciscus Cataneus Panegyricus in amore (Latin text)

f. 57^{r} [Euclid]

f. 57^{r} Euclid

f. 80^{v} Anonymous Ὅτι ἔργα κάλλιστα καὶ θειότατα ἐν τῷ κόσμῳ ἐστὶν

Description taken from the manuscript facsimile; there is no published catalogue for codices 867-1287, but cf. Richard #724.

This codex contains only a brief passage from the Εἰσαγωγὴ ἁρμονική (29.10-29.17).

Brief mention is made in Jan lxxiii (#154a).

33. Vaticanus gr. 1341 (Q)

XIV-XV century, paper, 8^{o}, 30 11/p., 210 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 177^{r}- 184^{r})

Contents:

f. 8^{r} Aristotle Topica

f. 166^{r} Περὶ τοῦ τῶν ῥητορικῶν προοιμίων

f. 172^{v} Praefationes in Aphthonii Progymnasmata

f. 174^{v} Anonymous De musica

f. 177^{r} [Euclid]

f. 184^{v} Nicetas Heracleensis Varia scripta

Description taken from the codex; there is no catalogue available for codices 867-1287.

This codex once belonged to Fulvius Orsini, and it was used by Possevinus for his Latin translation of the Εἰσαγωγὴ ἁρμονική. See P. de Nolhac, Bibliothèque de Fulvius Orsini in Bibliothèque de l'École des Hautes Études; Sciences Philologiques et Historiques 64 (Paris 1887) 125 and 337; it was #34 in Orsini's collection. Nolhac is the only catalogue available for codices 1288-1421, but he is incomplete. For Possevinus, see infra, p.

Only the Aristotelian treatise is mentioned in Dieter Harlfinger and Jurgen Wiesner, "Die griechischen Handschriften des Aristoteles und seiner Kommentatoren," Scriptorium 18 (1964) 255, and Aubrey Diller, "The Library of Francesco and Ermolao Barbaro," Italia Medioevale e Umistica 6 (1963) 259. This codex is not employed by W. D. Ross, Aristotelis Topica et Sophistici Elenchi (Oxford 1958).

Following the rhetorical treatise (f. 166^{r}) are several prefaces to Aphthonius' Progymnasmata--not "Aphthonius De musica (Jan);

33. (cont'd)

the treatise on music which follows has never been identified.

34. Vaticanus gr. 1346

XVI (?) century, 25 11/p., 223 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 207^{r}- 222^{v})

Contents:

f. 1^{r} Achilles Tatius (Astronomus) Πρὸς εἰσαγωγὴν εἰς τὰ Ἀράτου φαινόμενα

f. 180^{r} Aristarchus Περὶ μεγεθῶν καὶ ἀποστημάτων ἡλίου καὶ σελήνης

f. 207^{r} [Euclid]

Description taken from the codex; see also Nolhac (supra, p. 39) 187 and 337.

Jan (lxxv (#157a)) states that this codex was number 33 in the Orsini collection, but Nolhac clearly numbers it 1347. E. Maass, Commentariorum in Aratum reliquae (Berlin 1898) xvi-xviii, 26, omits mention of this codex, as do Jean Martin, Histoire du texte des Phénomenès d'Aratos (Paris 1956) 309; Martin, ed., Scholia in Aratum vetera (Stuttgart 1974) i-xxxvii; and Sir Thomas Heath, Aristarchus of Samos (Oxford 1913) 325.

35 and 36. Vaticanus gr. 2338 (C and P)

XII-XIII century, paper, folio quarto, 345 x 255mm., 58-60 11/p., 44 ff.

Εἰσαγωγὴ ἁρμονική attributed to Cleonides (f. 1^v- 3^v) and to Pappus (f. 9^v- 12^r)

Contents:

I.

f. 1^v Cleonides

f. 3^v Euclid

f. 4^v Gaudentius

f. 8^r Secessionum a Romana Ecclesia orientali index

f. 8^v Theon

f. 9^v [Pappus]

f. 12^r Aristoxenus

f. 21^r [Ptolemy]

II.

f. 23^r Panegyricus quisdam xiii saeculi

III.

f. 38^v Sermo recens in theophania divo Proclo tributa

IV.

f. 39^r Epistulae variae

Description taken from the unprinted manuscript by I. Cozza-Luzi, Inventarium codicum Graecorum Bibliothecae Vaticanae a 1501-2402 ad num., available from the Institute de Recherche in Paris.

Da Rios (xx-xxv) distinguishes four hands in the first part of this codex. It once belonged to the Library of the Church of S. Andrea della Valle (Rome). See also Hiller 6 and 20-57; Jan omits this codex.

37. Vaticanus gr. 2365

XVI century, paper, folio max., 365 x 255mm., 60 ll/p., 463 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 373^{v}- 380^{v})

Contents:

f. 1^{v}	Aristides Quintilianus
f. 64^{r}	Ptolemy
f. 131^{v}	Porphyry
f. 247^{v}	Bryennius
f. 357^{v}	[Plutarch]
f. 373^{v}	[Euclid]
f. 381^{v}	Euclid
f. 387^{v}	Aristoxenus
f. 415^{v}	Alypius
f. 435^{v}	Gaudentius
f. 447^{v}	Nicomachus

Description taken from codex and Cozza-Luzi (see supra, p. 42) ad loc.

Düring (Porph. xiv (#57)) believes this codex was written by Bartholomeus de Zanettis, for whom cf. codex 1; but Jonker (42) disagrees. See also D. Tamilia, "Index codicum graecorum qui Romae in Bibliotheca Nationali olim Collegii Romani adservantur," Studi Italiani Filologia Classica 10 (1902) 223-36; and Catalogus manuscriptorum--Sala di Consultazione (=Richard p. 199) MS 324 (f. 239^{r}-239^{v}).

Brief mention is made also in da Rios xlvii-xlviii, Lasserre #32, Einarson-De Lacy viii, and Winnington-Ingram #29. Düring

(Ptol.) omits mention of this codex, as does Jan.

38 and 39. Vaticanus Barberinus gr. 265 (II/86, olim 270)

XVI century, paper, folio min., 335 x 225mm., 36 ll/p., 466 pp.

Εἰσαγωγὴ ἁρμονική attributed to Pappus (pp. 300-310) and to Cleonides (pp. 311-18)

Contents:

p. 1 Aristoxenus

p. 50 Ptolemy

p. 195 Porphyry

p. 271 [Plutarch]

p. 295 Theon

p. 300 [Pappus]

p. 311 Cleonides

p. 318 Euclid

p. 327 Aristides Quintilianus

p. 411 Bacchius

p. 419 [Bacchius]

p. 423 Alypius

p. 435 Gaudentius

p. 451 Anonymous Bellermann

Description taken from Seymour de Ricci, "Liste sommaire des manuscrits grecs de la Bibliotheca Barberina," Revue des Bibliothèques 17 (1907) (=Richard #728) 100.

Like codices 30 and 43, this codex was written by Johannes Honorius of Mallia, in this example for Marcello Cervini.

Jan (lxxvii-lxxxi) designates this codex as "B," but this siglum does not specify which of the two versions of the Εἰσαγωγὴ

ἁρμονική in this codex he means; cf. supra, codex 18-19 ("N"). Brief mention is made by da Rios xxxvii-xxxviii, Düring Ptol. xxxvii (#70), Düring Porph. #58, Weil-Reinach xliv, Heiberg-Menge VIII xlvi, Einarson-De Lacy ix, and Najock 31-32. Winnington-Ingram omits this codex from his list.

40. Vaticanus Ottobonianus gr. 372

XVI century, paper, 285 x 195mm., 22 ll/p., 46 ff.

Εἰσαγωγὴ ἁρμονική attributed to Zosimus (f. 38^{v}- 46^{v})

Contents:

f. 1^{v} Aristotle Nik. Eth.

f. 38^{v} [Zosimus]

Description taken from E. Feron and F. Battaglini, Codices manuscripti Graeci Ottoboniani Bibliothecae Vaticanae (Rome 1893) (=Richard #733) 190.

The final folio of the codex (46^{v}) contains the colophon Φραγκίσκος ὁ σὸς φίλος.

The title of the Εἰσαγωγὴ ἁρμονική has here been rendered as Ἐπὶ ἁρμονίας. The last part of the treatise (29.10-29.17) is attributed to Euclid

Jan omits mention of this codex.

41. Vaticanus Reginensis gr. 94

XVI century, paper, folio, 280 x 190mm., 30 ll/p., 170 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 119^{v}- 125^{r})

Contents:

f. 1^{r} Julian Antiochus

f. 20^{r} Nonnus Arbas Opera tria

f. 47^{v} Philo Judaeus Opus minus

f. 71^{v} Alypius

f. 84^{r} Nicomachus

f. 95^{v} Hero Pneum.

f. 119^{v} [Euclid]

f. 125^{r} Euclid

f. 130^{r} Aristoxenus

f. 143^{v} Gentianus Hervetus Aurelius Oratio

Description taken from Henry Stevenson, Codices manuscripti graeci Reginae Suecorum et PII PP.II Bibliothecae Vaticanae (Rome 1888) (=Richard #735) 69-70. The final treatise was written (in Latin) by De Sanctis.

See also Jan lxxvii (#170) and da Rios xlvi-xlvii.

42. Vaticanus Reginensis gr. 169

XV century, paper, 8^{o}, 21 ll/p., 25 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 1^{r}- 16^{r})

Contents:

f. 1^{r} [Euclid]

f. 16^{r} Euclid

Description taken from Stevenson (see supra, p. 48) 115.

This codex was once "ex libris D. M. Hospitalis Franciae cancellarii, Dono d. a. D. convers XXIIII^{a} Martii 1587" (f. 1^{r}). Later it belonged to Alexander Petavius, senator of Paris.

See also Jan lxxvii (#171^{b}).

43. Vaticanus Rossianus gr. 977 (XI,127)

XVI century, paper, 320 x 230mm., 36 ll/p., 206 pp.

Εἰσαγωγὴ ἁρμονική attributed to Cleonides (pp. 1-9)

Contents:

p. 1 Cleonides

p. 9 Euclid

p. 15 Gaudentius

p. 31 Bacchius

p. 38 [Bacchius]

p. 43 Aristoxenus

p. 75 Aristides Quintilianus

p. 147 Theon

p. 161 Alypius

p. 173 Anonymous Bellermann

p. 185 [Plutarch]

Description taken from da Rios xxxix and the codex; da Rios omits the distinction between the Εἰσαγωγὴ ἁρμονική and the Sectio Canonis.

Johannes Honorius of Mallia wrote this codex; cf. codd. 38-39.

See also C. Van de Vorst, "Verzeichnis der griechischen Hss. der Bibliotheca Rossiana," Zentralblatt für Bibliothekswesen 23 (1906) (=Richard #738) 492-508, 537-50; Winnington-Ingram #9; and Najock 33, who takes his description from da Rios and again omits the distinction between the treatises of Cleonides and Euclid.

44 and 45. Vaticanus Urbinas gr. 77

XVI or XVII century, paper, 329 x 223mm., 30 11/p., 352 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 1^r- 7^v) and to Pappus (f. 193^r- 201^r)

Contents:

f. 1^r [Euclid]

f. 8^r Euclid

f. 12^v Aristoxenus

f. 39^r Aristoxenus rhyth.

f. 44^v Ptolemy

f. 104^v Porphyry

f. 165^r Nicomachus

f. 174^v Planudes Scipionis somnium

f. 176^r Barlaamus Commentarium in Harmonica Ptolemaei

f. 188^v Theon 1-12

f. 193^r [Pappus]

f. 204^v Aristides Quintilianus

f. 262^v Bacchius

f. 268^r [Bacchius]

f. 272^v Hymns

f. 273^r Anonymous Bellermann

f. 280^v Alypius

f. 296^v Gaudentius

f. 310^v Theon

Description taken from Cosimus Stornajolo, Codices Urbinates Graeci Bibliothecae Vaticanae (Rome 1895) (=Richard #739) 103-106, who

proposes the seventeenth-century date. Najock (33-34) argues that the watermarks resemble those from between 1500-1550; cf. Briquet (see supra, p. 16) #481 or #492.

Mention of this codex can also be found in Jan lxxv-lxxvi (#159); da Rios xlv-xlvi who omits the hymns, Planudes, and the final Theon; Westphal II 77-85; Hiller 47-57 and praef. vii; Düring Ptol. xxxviii-xxxix (#76); Düring Porph. #61; Amsel-Studemund (see supra, p. 7) 127; Heiberg-Menge VIII xiv; and Winnington-Ingram #16. For the hymns, see Theodor Bergk, "Zu den Hymnen des Dionysius und Mesomedes," Rheinisches Museum 9 (1854) 306-311; and E. Pöhlmann, Denkmäler altgriechischer Musik (Nürnberg 1970) 13-31, though Pöhlmann omits mention of this particular codex.

46. Venetus Marcianus gr. 322 (olim 711) (U)

XV century, parchment, folio mag., 355 x 230mm., 44 ll/p., 239 ff.

Εἰσαγωγὴ ἁρμονική attributed to Euclid (f. 97^{v}- 101^{r})

Contents:

f. 1^{v}	Aristides Quintilianus
f. 30^{v}	Bryennius
f. 89^{v}	[Plutarch]
f. 97^{v}	[Euclid]
f. 101^{r}	Euclid
f. 103^{r}	Aristoxenus
f. 117^{r}	Alypius
f. 127^{v}	Gaudentius
f. 134^{r}	Nicomachus
f. 141^{v}	Ptolemy
f. 177^{v}	Porphyry (in l, 2)

Description taken from A. M. Zanetti and J. Morelli, Bibliotheca manuscripta graeca et latina I (Bassano 1802) (=Richard #845); and Eldipius Mioni, Bibliothecae Divi Marci Venetiarum codices graeci manuscripti II (Rome 1960) (=Richard #848) ad num.

This codex was written by Johannes Rhosus, and bears a possession note of Cardinal Bessarion, "κτῆμα Βησσαρίωνος καρδηνάλεως τοῦ Νικαίας ἐπισκοποῦ σαβίνων" ("Cardinal of Nicaea and Bishop of the Sabines"). Bessarion had the bishopric of Sabina between March 5 and April 23, 1449. This manuscript was donated with others from Bessarion's library to Venice in 1468.

This codex is also mentioned by Jan lxxxii-lxxxviii (#184);

Amsel-Studemund (see supra, p. 7) 155; Düring Ptol. xlii-xliv (#82); Düring Porphyry #65; da Rios xxxi-xxxii; Lasserre #14; Vogel-Gardthausen (see supra, p. 5) 193; Jonker 43 (355); Einarson-De Lacy ix; Weil-Reinach xli; Marquard xxv and xxxii; and Jahn xlviii, n. 5.

47. Venetus Marcianus app. cl. gr. VI/3 (=Coll. 1347) (M)

XII century with additions and corrections from the XII-XV centuries, parchment, 4° mai., 261 x 192mm., 28 ll/p. for ff. 1-8, 20 ll/p. for ff. 9-95, 95 ff.

Εἰσαγωγὴ ἁρμονική attributed to no one, though to Euclid in a second hand (f. 1^{v} - 8^{v})

Contents:

I.	f. 1^{v}	[Euclid]
	f. 8^{v}	Euclid
	f. 16^{v}	Aristoxenus
	f. 66^{v}	Alypius
	f. 91^{v}	Aristoxenus rhyth.
II.	f. $1^{vmg.}$	Aristides Quintilianus
	f. $6^{vmg.}$	Anonymous Bellermann
	f. $16^{vmg.}$	Nicomachus
	f. $34^{vmg.}$	Bacchius

Description taken from Mioni (see supra, p. 53) II 6f.

The texts contained in "II" are written in the margins of I in a fourteenth-century hand. The Anonymous Bellermann actually contains only #29-57 of Anonymous III and is written in a late fourteenth or early fifteenth-century hand. This codex has undergone many corrections, but unfortunately these corrections were too often made by completely scratching or blotting out the original readings. Jan (xvii-xviii) divides this codex into six hands: M--the original twelfth-century hand; M^{1}--corrector of M; M^{mg}--marginal readings (corrections and additions) of the fourteenth century; M^{3}--fifteenth-century corrections which echo the readings in Neapolitanus gr. III. C. 2

(codex 18-19); M^4--readings not found in Neapolitanus III. C. 2 but in U (codex 46), L (codex 12), and Monacensis gr. 104 (codex 17); M^5--readings not in U. Cf. P. Marquard, Die harmonischen Fragmente des Aristoxenus (Berlin 1868) xiif. But Menge (vii) is correct in saying, "Codex pluribus manibus, quae haud sane facile dignoscuntur, variis aetatibus correctus est." See further discussion, infra,

Mention is made of the codex by da Rios xxv-xxix; Winnington-Ingram #62; Jahn xlviii, n. 5; Westphal II xc; Najock 34-35; and Jan xvi-xxiv.

THE MANUSCRIPT TRADITION:

All of the manuscripts which preserve the Εἰσαγωγὴ ἁρμονική fall into seven categories. Each category of manuscripts can be distinguished by peculiar readings, and for six of these categories the distinction can be made by the author attribution. While the variety of author attributions raises a difficult problem for the historian of music, this same variety nonetheless is useful for the preliminary establishment of interrelationships between the manuscripts. The Εἰσαγωγὴ ἁρμονική is attributed in the manuscripts to four authors: Euclid, Cleonides, Pappus, and Zosimus. Some manuscripts credit it to an anonymous author or make no attribution.

Euclid: 1, 2, 6, 7, 12, 17, 20, 21, 22, 23, 26, 27, 32
33, 34, 37, 41, 42, 44, 46

Cleonides: 4, 5, 9, 13, 19, 25, 35, 39, 43

Pappus: 3, 10, 24, 31, 36, 38, 45

Zosimus: 15, 40

Anonymous: 14, 16, 18

No attribution: 8, 11, 28, 29, 30, 47

The anonymous and unattributed manuscripts can be readily assigned by their readings to named groups.

The twenty copies of the Εἰσαγωγὴ ἁρμονική attributed to Euclid are descended from one of two manuscripts: Q and U.[1] Q and its descendants consist of three manuscripts attributed to Euclid--26, 33(Q), and 34--as well as the three manuscripts attributed to "Anon-

ymous"--14, 16, and 18. U and its descendants comprise all the other manuscripts attributed to Euclid. There is no such division for the manuscripts attributed to Pappus, Zosimus, and Cleonides; these are all descended from P, Z and C, respectively. The earliest and most reliable manuscripts for establishing a text of the Εἰσαγωγὴ ἁρμονική are MCP, to be discussed presently.

M:

M (47, Venetus Marcianus app. cl. gr. VI/3) had been considered as our oldest and most important single manuscript until the collation of a second twelfth-century codex, Vaticanus gr. 2338, which contains two versions of the treatise (35-36). It can be shown that no single extant manuscript depends solely on M, though many of the readings in VUZ derive from it (or its corrected version) directly or indirectly, and many of the readings in CP parallel those in M. Because of its age and its influence on the tradition its readings are of prime importance.

Unfortunately, M presents several difficulties for transcription and dating. The ink of the original hand is worn, rendering several passages barely legible--1.1-4.4, 10.4f., 13.3f., 18.17f., 20.14f., 22.5f., and 24.1f.; and a number of correcting hands have changed the text and obscured the original readings.

Jan boldly divided the corrections to M (the original twelfth-century hand) into five sets: M^1--the early corrector of M; M^{mg}--fourteenth-century marginal corrections and additions; M^3--fifteenth-century corrections found in N; M^4--corrections not in N but in U(46), L(12), and Mon. gr. 104 (17); and M^5--corrections not in U.[2]

The manuscripts with which Jan was to identify M^4 are equivalent to my U. According to Jan, U used M^4 and N used M^3. However it can now be shown that N is a descendant of the twelfth-century Vaticanus gr. 2338. Rather, the fifteenth-century corrector (M^3) must have had access to a descendant of C when making his corrections. Moreover, Jan's analysis must be questioned both because of the difficulty of distinguishing the later hands in M, [3] and because his research into the rest of the manuscript tradition was incomplete.[4] The situation is more complicated than Jan had thought, as will be seen. Therefore, in the following apparatus all correcting hands are united under one siglum (M^1) and distinguished from the original, M.

The following three significant omissions show that M is not the unique source of our tradition:

13.8 ἡμιόλιον--14.2 δὲ τὸ

24.12 νέους

26.1 φρύγιοι--26.2 καλεῖται

All of these omissions, however, are corrected by M^1.

C:

Jan did not employ Vaticanus gr. 2338 in establishing his text, and in doing so he neglected two of our most important twelfth or thirteenth-century sources--C and P. This codex contains the best and earliest versions of the treatise for both C and P-type manuscripts, as will be shown.

There are nine manuscripts which attribute the treatise to Cleonides: 4, 5, 9, 13, 19, 25, 35, 39, and 43. 30 has no attribution, but it belongs to this group. It resembles very closely 39, even to

the point of matching folios; both were written by Honorius. I have given the siglum C (for Cleonides) to this group in lieu of Jan's N; I do not use N because 19 is not the best representative of the manuscripts attributed to Cleonides. The oldest representative of this group is 35 of the twelfth or thirteenth century, followed by 19 of the fifteenth century. The rest were all copied in the sixteenth century.

The variants among the C-type manuscripts can be diagrammed as follows:

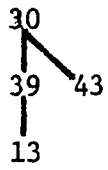
	4	5	13	19	25	35	43
1.7	συστημάτων	-τοϱ	-τος	-τος	-τος	-τος	-τος
2.1	--	add. ὑπο	--	--	add. ὑπο	--	--
3.4	add.	add.	add.	add.	add.	add.	add.
4.21f	hab.	om.	hab.	hab.	om.	hab.	hab.
6.1	--	spatium	ἐναρμόνιος	--	spatium	ἐναρμόνιος	--
6.15	corr.	corr.	incorr.	corr.	corr.	corr.	corr.
6.20f	hab.	om.	hab.	hab.	om.	hab.	hab.
7.9	διεζευγ.	ἑζευγ.	om.	om.(συν. mg)	ἑζευγ.	om.	om.
8.11	τρίτη	τρίτη	τῶν	τρίτη	τρίτη	τρίτη (τῶν) olim	τρίτη
9.17	ἐλάττων	ἐλάττων	ἐλάττων	ἐλάττω	ἐλάττων	ἐλάττων	ἐλάττων
9.17	schol.	schol.	--	--	--	schol.	--
10.14f	om.	hab.	hab.	hab.	hab.	hab.	hab.
11.16f	om.	om.	om.	om.	om.	om.	om.
12.10	add. τετ.	add.	add.	add.	add.	om.	add.
12.14	τόνου om.	om.	om.	om.	om.	om.	om.
13.1	ἡμιολίαν	ὁμιολίαν	ἡμιολίαν	ὁμιολίαν ἡ- supra	ὁμιολίαν	?	ἡμιολίαν
13.3	add. τρὶς	add. τρὶς	add. ἑπτὰ	add.τρὶς	add. τρὶς	add. τρὶς	add. τρὶς
14.8	add.	add.	add.	add.	add.	--	add.

	30	9	39
1.7	-τος	-τος	-τος
2.1	--	--	--
3.4	add.	add.	add.
4.21f	hab.	hab.	hab.
6.1	έναρ. perfos.	--	έναρ. in mg.
6.15	incorr.	corr.	corr.; incorr.(in mg.)
6.20f	hab.	hab.	hab.
7.9	om.	συνημ.	om.
8.11	τρίτη	τῶν	τῶν
9.17	τῶν in mg. ἐλάττων	ἐλάττω	ἐλάττων in mg.
10.14f	hab.	hab.	hab.
11.16f	om.	om.	om.
12.10	add. perfos.	add.	add. perfos.
12.14	om.	om.	om.
13.1	ἡμιολίου	ἡμιολίαν	ἡμιολίου
13.3	add. τρὶς	add. τρὶς	add. ἑπτὰ
14.8	add. perfos.	add.	add. perfos.

	4	5	13	19	25	35	43
15.2	ιβ(prius)	ιβ	ιε	ιβ	ιβ	ιβ	ιε
17.12f	om.	hab.	hab.	hab.	hab.	hab.	hab.
18.20	schol.	schol.	--	schol.	--	schol.	--
18.20f	οὖ--όξυ(1)	ἐν--όξυ(2)	οὖ--όξυ(1)	οὖ--όξυ(1)	ἐν--όξυ(2)	οὖ--όξυ(1)	οὖ--όξυ(1)
19.10	om. ὑπατῶν	om. ὑπατῶν	om. ὑπο ὑπατῶν ὑπο πασῶν	om. ὑπατῶν	om. ὑπατῶν	om. ὑπατῶν	om. ὑπο πασῶν
21.16	ἐξῆς om.	hab.	--	hab.	hab.	hab.	hab.
20.13-26.17	hab.	hab.	om.	hab.	hab.	hab.	hab.
22.3	ἡ ἐκ	ἡ ἐκ	--	ἡ ἐκ	ἡ ἐκ	ἐκ olim ἡ ἐκ in mg.	ἡ ἐκ
22.4	ὑπ.--φθ. hab. bis		--	un.	bis	un.	un.
26.5	bis add.	add.	--	add.	add.	om.	add.
27.17	κοινωνία	κοινωνία	κοινωνία	κοινοντία	κοινωνία	κοινωνία	κοινωνία
28.12	διάστημα	κατάστημα	κατάστημα	κατάστημα	κατάστημα	κατάστημα	κατάστημα

	30	9	39
15.2	ιε	ιβ	ιε
17.12f	hab.	hab.	hab.
18.20	--	--	--
18.20f	οὖ--όξυ(1)	οὖ--όξυ (1)	οὖ--όξυ(1)
	om.	om.	om.
19.10	ὑπο παιῶν	ὑπατῶν	ὑπο παιῶν
	corr. mg.		corr. mg.
21.16	hab.	hab.	hab.
20.13-26.17	hab.	hab.	om.
22.3	ἡ ἐκ	ἡ ἐκ	--
22.4	un.	un.	--
26.5	add. perfos.	add.	--
27.17	κοινωνία	κοινοντία	κοινωνία
28.12	κατάστημα	κατάστημα	κατάστημα

To begin from the sixteenth-century manuscripts, 39 omits the passage from ὑποδώριον (20.13) to φωνῆς (26.17) between the end of its p. 316 and the beginning of its p. 317, equivalent to two folios. 13 makes the same omission but in the middle of a folio (f. 113^{v}). 13 is then probably an apograph of 39. 30, like 39, was copied by Honorius. It shares numerous conjunctive errors with 39, but 30 cannot derive from 39 since it preserves the passage from 20.13 to 26.17 which 39 omits. 39 is inferior to 30, and Honorius either copied 39 from 30 or from its exemplar. 43 was also copied by Honorius. In 43 there are several passages taken from a corrected 30. Where 30 has deletions (marked by underscorings) at 6.15, 8.11, 12.10, and 13.3, Honorius has eliminated the words in 43. At 19.10, however, 43 preserves the incorrect reading (ὑπὸ πασῶν) of 30 which Honorius corrected in his margin (ὑπατῶν). Thus we arrive at the following relationships between 13, 30, 39, and 43:



5 and 25 share numerous errors against the rest of the C-type manuscripts. This is seen most clearly in the omissions at 4.21f. and 6.20f. and the variant readings at 7.9, 13.1, and 18.20f. 5 predates 25 and would thereby seem to be the source for 25, despite the fact that 25 neglects the (unenlightened) scholia which 5 contains at 9.17 and 18.20, and corrects spelling errors in 5--egg. 12.15 ἡμίσι, 13.2 διαίεσιν to ἡμίσυ and δίεσιν.

4 shares significant conjunctive errors with 5 and 25; cf. 7.9 (with a slight change), 22.4, and 1.2 (εἰσαγωγῆς ἁρμονικῆς). At

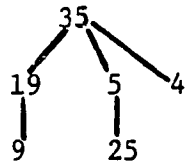
7.9, 4 (διεζευγμένων) has corrected the errant, nonsensical reading (ἐζευγμένων) of 5 and 25. 4 again corrects 5 and 25 at 2.1, 4.21f., 6.1, 6.20f., 13.1, and (incorrectly) at 29.12, and in doing so the scribe of 4 shows a rudimentary knowledge of Greek musicological terminology. 4 also shows some significant separative errors against 5 and 25; cf. the omissions at 10.14f., 17.12f., and 21.16. Since 4 contains the scholia (9.17 and 18.20) found in 5 and not found in 24, 4 may be considered a gemellus of 5.

9 and 19 share two significant errors against the rest of the C-type manuscripts--συνημμένων at 7.9 and κοινοντία at 27.17. 19 adds the variant at 7.9 in the margin which 9 has in the text. This is again true at 4.14 and 13.1 and so 9 must derive from 19. Note also that 9 omits 4.19, which is preserved in 19.

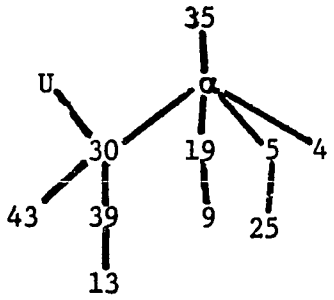
35 contains the same scholia (9.17 and 18.20) found in 4 and 5, and 5 leaves a space at 6.1 where 35 had added ἐναρμόνιος. In addition, 5 adds the extra ὑπὸ at 2.1, the unnecessary βαρύτης... at 3.4, and the τεταρτημόριον at 12.10 and at 14.8, and it omits the absolutely essential material at 6.20f.; all of these passages 35 preserves correctly, and so 5 must derive from 35 which predates 5 by 200 to 400 years. Both 5 and 25 falsely copy (4.21f., 6.20f., 22.4) or add to (or emend) 35's text; cf. 3.4, 7.9, 14.8, 18.20f., and 26.5. 4 which also derives from 35, deletes the ὑπὸ at 2.1 and makes other corrections (1.7).

19 shares the scholion with 35 at 18.20, and it, too, makes the unnecessary additions to 35's text at 3.4, 7.9, 12.10, 14.8, and 26.5. The συνημμένων at 7.9 which 19 adds to its margins is hard to trace. 35 omits the word entirely, and συνημμένων is not a

variant offered in other manuscript families. Nonetheless, 19's συνημμένων is certainly incorrect. 19 shares slightly different readings with 35 against 5 (and 25)--4.21f., 6.20f., 7.9, 18.20f., 22.4; in each case 5 preserves a text which is inferior to 19. There is one exception, however, where 5 preserves the scholion omitted by 19 at 9.17. (5's correction at 27.17 could be either a correction of 19's κοινοντία or it could provide more evidence that 5 and 19 are gemelli.) Apparently 5 and 19 are gemelli, both descended from 35. There seems to have been an intermediary between 35 and 19, 5, 4, which made the additions at 3.4, 12.10, 14.8, and 26.5.



The relationship between 30 and 35 is one of dependence in which 19 and 30 are gemelli both descended from 35. Both 19 and 30 added the words or passages at 3.4, 12.10, 14.8, and 26.5, but Honorius (30) erased, i.e. underlined, these additions at 12.10, 14.8, and 26.5. Where 35 added ἐναρμόνιος at 6.1, Honorius underlines it and 19 omits it entirely. 30, however, apparently used U for its incorrect version of 6.15, and it mistakenly writes ἑπτὰ at 13.3 and $\overline{\iota\varepsilon}$ at 15.2; 30 also omits the scholion at 18.20, so 19 cannot have derived from 30. Nor is it possible that 30 is derived from 19 rather than from 35, for 30 preserves 35's ἐναρμόνιος (6.1), τῶν (8.11), ἐλάττων (9.17), and κοινωνία (27.17); all of these readings 19 does not preserve. Ultimately, 35 is the lone representative of C. In the following stemma alpha represents the version which first made the additions at 3.4, 12.10, 14.8, and 26.5.



The readings of 35 are given in the apparatus as C. C^1 signifies a correcting hand in C(35), and C^2 signifies the additions made by the remainder of the C-type manuscripts--all (=α) or some of those manuscripts other than 35 and 35^1; these readings of C^2 are reported only where they are valuable or of some particular interest, e.gg. 3.4 and 26.5.

P:

There are seven manuscripts of the treatise attributed to Pappus, inevitably with the phrase, "ἐκ τῶν τοῦ Πάππου": 3, 10, 24, 31, 36, 38, and 45.[5] 10 has been lost since World War II, and 31 stands in such a poor state of preservation that it cannot be read. All the remaining manuscripts attributed to Pappus share several peculiar characteristics other than the author attribution. All omit the title of the work as well as the introductory sentences defining ἁρμονική (1.3-1.6 ἑπτά). The seven parts of ἁρμονική are then merely listed--all in the plural except for μελοποιίας. Only the manuscripts attributed to Pappus have these peculiarities, and all of these manuscripts have them. Other variants unique to P-type manuscripts include 3.2 ἀποτελέσματα, 10.1 τραχῦναι, and 14.12 δι' ἀριθμῶν. The siglum P is given because of the attribution to Pappus.

Two other manuscripts, 8 and 11, omit not only the title

and the introductory sentences defining ἁρμονική but also the list of the seven parts of ἁρμονική and begin the treatise only at 1.9 with the definition of φθόγγος. Although they also lack the attribution to Pappus, they share the distinctive readings at 3.2, 10.1, and 14.12 and are obviously in a filial relationship to one of the Pappus manuscripts. The oldest manuscript is 36, of the twelfth or thirteenth century, followed by 31 of the fourteenth. The rest are all of the sixteenth century. All members of this group can be shown to derive from 36.

The variants in the P-type manuscripts can be diagrammed as follows:

	3	8	11	24
1.1	ἐκ τοῦ Πάππου	om.	om.	ἐκ τῶν τοῦ Πάππου
1.2-6	om.	om.	om.	om.
1.7f	habet	om.	om.	habet
2.19	τιθεῖσα	τεθεῖσα	τιθεῖσα	τιθεῖσα
3.2	ἀποτελέσματα	ἀποτελέσματα	ἀποτελέσματα	ἀποτελέσματα
3.4	ὀξύτης δι'	ὀξύτης δὲ τὸ δι'	ὀξύτης δὲ τὸ δι'	ὀξύτης δὲ τὸ δι'
3.5	habet	habet	habet	habet
3.13	κατὰ τόνον	κατὰ τόνον	κατὰ τὸν τόνον	κατὰ τὸν τόνον
3.14	habet	habet	habet	om.
4.13	νήτη	om., τρίτη in mg.	νήτη	νήτη
5.9f	habet	habet	om.	habet
6.9f	om.	habet	habet	habet
6.19f	habet	om.	habet	habet
7.6	νήτη	νήτη	νήτη	νήτη
7.25	κινούμενοι δὲ, οἱ	κινούμενοι δὲ οἱ	κινούμενοι οἵδε, οἱ	κινούμενοι δὲ, οἵδε, οἱ
8.10	παρυπάτη ὑπ.	παρυπάτη ὑπ.	παρυπάτη ὑπ.	παρυπάτη ὑπ.
8.13	χρωματικοί	χρωματικοί	χρωματική	χρωματική

	3	8	11	24
8.22f	habet	habet	habet	habet
9.5	τὰ ἀσύνθετα τῶν συνθέτων	τὰ ἀσύν. τῶν συν.	τὰ ἀσύν. τῶν συν.	τὰ ἀσύν. τῶν συν.
9.11f	διατονικά--διαστημάτων om.	habet	habet	habet
10.1	τραχῦναι	τραχῦναι	τραχῦναι	τραχῦναι
10.4f	ἀσύνθετα hab.	hab.	om.	hab.
11.2	διτόνου	διτόνου	διατόνου	διατόνου
11.10	ἔσται	ἔσται	ἔστω	ἔσται
12.10	add. τεταρτημόριον	add.	add.	add.
13.8f	αὐτῷ--τόνου om. add. in mg.	hab.	hab.	hab.
13.8f	τῶν--δε το (14.2) om.	om.	om.	om.
14.12	δι' ἀριθμῶν	δι' ἀριθμῶν	δι' ἀριθμῶν	δι' ἀριθμῶν
15.2	om.	om.	om.	om.
diagram	--	--	--	hab.
15.7f	hab.	om.	hab.	hab.
16.11f	om.	hab.	hab.	hab.
20.19f	πέμπτον--ὀξὺ (21.1) om.	τρίτον --ὀξὺ (20.20) om.	βαρὺ--τὸ (20.19) om.	--

	3	8	11	24
20.19	om.	om.	τετ.--βαρὺ post ὀξὺ (20.20)	τετ.--βαρὺ post ὀξὺ (20.20)
22.15	σύμφωνα ων	σύμφωνα	σύμφωνον	σύμφωνον
21.12	--	--	--	--
23.6	ὁρίζεται	ὁρίζεται	ὁρίζεται	ὁρίζεται
23.20	ἀπαθούς--ἀσύνθετον (23.22) om.	om.	om.	om.
26.4	ὧν ὁ βαρύτερος καὶ	καὶ	ὧν ὁ βαρύτερος και ἥ	ὧν ὁ βαρύτερος ἥ
26.11	ἡμιτόνιον, olim -ιφ	ἡμιτόνιον	ἡμιτόνιον	ἡμιτονίου
29.16	hab.	hab.	hab.	om.
20.22	--	--	βαρὺ] ὀξὺ	βαρὺ] ὀξὺ

	36	38	45
1.1	ἐκ τῶν τοῦ Πάππου	ἐκ τῶν τοῦ Πάππου	ἐκ τῶν τοῦ Πάππου
1.2-6	om.	om.	om.
1.7f	hab.	hab.	hab.
2.19	τιθεῖσα	τιθεῖca	τιθεῖσα
3.2	ἀποτελέσματα	ἀποτελέσματα	ἀποτελέσματα
3.4	ὀξύτης δὲ τὸ δι'	ὀξύτης δὲ τὸ δι'	ὀξύτης δὲ τὸ δι'
3.5	βαρ.--ἀνέσεως om.; hab. in marg.	hab.	hab.
3.13	κατὰ τόνον	κατὰ τὸν τόνον	κατὰ τὸν τόνον

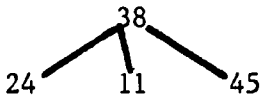
	36	38	45
3.14	hab.	hab.	hab.
4.13	νήτη	νήτη	νήτη
5.9f	hab.	hab.	hab.
6.9f	hab.	hab.	hab.
6.19f	hab.	hab.	hab.
7.6	νήτη	νήτη	νήτη
7.25	κινούμενοι δὲ, οἱ	κινούμενοι οἵδε, οἱ	κινούμενοι οἵδε, οἱ
8.10	ὑπάτη ὑπ.; corr. P^1	παρυπάτη ὑπ.	παρυπάτη ὑπ.
8.13	χρωματικοί	χρωματικοί	χρωματικοί
8.22f	hab., sed perf.; add. in marg.	hab.	hab.
9.5	τὰ άσύν. τῶν συν.	τὰ άσύν. τῶν συν.	τὰ άσύν. τῶν συν.
9.11f.	hab.	hab.	hab.
10.1	τραχῦναι	τραχῦναι	τραχῦναι
10.4f	hab.	om.	om.
11.2	διτόνου	διατόνου	διατόνου
11.10	ἔσται	ἔστω	ἔστω
12.1-	--	add.	add.

	36	38	45
13.8f	om.	hab.	hab.
13.8f	om.	om.	om.
14.12	δι᾽ ἀριθμῶν	δι᾽ ἀριθμῶν	δι᾽ ἀριθμῶν
15.2	ια	ια	ια
diagram	hab.	hab.	hab.
15.7f	hab.	hab.	hab.
16.11f	hab.	hab.	hab.
20.19	τέταρτον olim, τρίτον P^1	βαρὺ--τὸ om.	βαρὺ---τὸ om.
20.19f	post ὀξὺ	post ὀξὺ	post ὀξὺ
20.22	τρίτον--βαρὺ om.	βαρὺ] ὀξὺ	βαρὺ] ὀξὺ
22.15	(water damage)	σύμφωνον	σύμφωνον
21.12	add. διέσεων	--	--
23.6	διορίζεται olim, ὁρίζεται P^1	ὁρίζεται	ὁρίζεται
23.20	hab. perfossum	om.	om.
26.4	ὧν ὁ βαρύτερος καὶ P^1	ὧν ὁ βαρύτερος καὶ ἥ	ὧν ὁ βαρύτερος καὶ ἥ
26.11	ἡμιτόνιον olim, -ιωP^1	ἡμιτονίου	ἡμιτονίου
29.16	hab.	hab.	hab.

11, 38, and 45 share several significant conjunctive errors against the other members of this group: 7.25, 10.4f., 11.10, 20.19f, 22.15, and 26.4. Of the significant separative errors they show against one another, at 1.1, 1.7, 5.9, and the diagram after 15.2, 11 makes omissions not found in 38 and 45. Similarly, at 8.13 11's χρωματική is an inferior reading to the χρωματικοί read in 38 and 45. 11 is derived from 38 or 45.

24 also shares numerous conjunctive errors with 38 and 45, of which 3.13, 15.2, 20.19, 20.22, and 26.11 are the most significant. At 3.14, 6.9, and 29.16, 24 makes important omissions not committed by 38 and 45. The omissions made by 38 and 45 at 10.4 could have been corrected by the scribe of 24, though 3, 8, and 36 also contain the correct reading; the same is true for the separative error at 11.10. The single conjunctive error shared by 11 and 24--8,13--must be attributed to accidental iotacism. They are not too closely related, even though both are in a dependent relationship to 38 and/or 45.

38 and 45 share no significant separative errors, but 45 contains a great number of orthographic and grammatical peccadillos which are absent in 38, e.gg. 2.2 διαστήματι, 3.12 γένει, 3.16 τρι ἡμιτόνιον, 4.4 προς λαμβανόμενος, and 8.1 βαρύπυκνοι. 45 is therefore most likely an inferior gemellus or copy of 38. Since neither 24 nor 11 shares these orthographic problems, they probably both derive from 38 rather than from 45.



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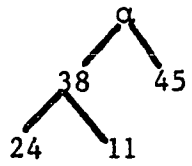
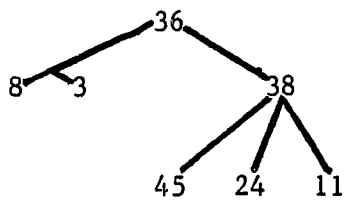


3, 8 and 36 form a triad of P-type manuscripts. They share conjunctive errors at 3.13, 7.25, 11.2, and 26.11. The twelfth-century 36 is clearly the source of the two sixteenth-century manuscripts. 3 shows separative errors against 8 and 36 at 3.4, 6.9, 9.11f., 16.11f, and 20.19. Significant separative errors at 1.1, 2.9, 4.13, 6.19, 15.2, and 15.7f. all show 8 to be inferior and dependent upon 36. Again, 8 makes more orthographical and grammatical errors than 3: 2.19 τεθεῖσα, 2.17 συνεχῆ, 11.6 τρίγωνον, and 11.7 μέθη.

Separative errors also show that 36 is the source of 38: 3.13, 10.4, 11.2, 20.19, and 23.20. 36 is a corrected copy, and 38 follows the correction made by 36's second hand (P^1): 3.5, 8.10, 8.22f., 23.6, and 23.20. At 12.10 38 adds τεταρτημόριον which 36 omits, but the word does not belong to Cleonides' pen. At 13.8f. 36 omits αὐτῷ κατα σύνθεσιν τόνου while 38 has it, and this suggests either a mistake in 36 or an addition in 38. Nonetheless, 38 errs frequently where 36 does not--3.13, 7.25, 11.2, 11.10, 20.19, and 26.4--and 38 clearly follows the corrections of P^1. 36 is the lone representative of the P-type manuscripts. Interestingly, 36 belongs to the same codex (Vat. 2338) as 35, the lone representative of C-type manuscripts.



THE RELATIONSHIP OF MCP:

MCP are obviously related. They share significant errors at 3.4, 8.10, 12.14, 13.3, 16.16, 20.15(bis), 21.13, 22.2, 22.3, 23.6, 24.14, 26.11, 27.17, 28.4, and 29.4. But all attempts to isolate any of the three or to establish a dependent relationship between them fail. MC often share readings against P: 1.5, 1.7(bis), 1.8, 3.5, 3.8, 4.4, 6.1, 19.1, 23.11, 23.12, 23.21, 26.12, and 27.13. In some instances MC's readings are superior to P's, especially 1.2-1.6 which P omits, and in other instances they are far inferior, e.g. 19.1f which MC omit. PC share poor variants against M at 6.15 and 20.16, but elsewhere P and C prove that they are not dependent on M, e.gg. 13.1, 19.1, and 28.20.[6] The only statement one can make about MCP is that they are three twelfth or thirteenth-century manuscripts all of which represent various versions of their exemplar and that MC are more closely related than MP or PC. Lastly, MCP are not the only manuscripts which represent the "earliest" tradition of the treatise, for MCP omit an essential word or passage at 13.8, 16.16, 16.21, 17.1, 17.5, 17.6, 20.15, 22.2f, 23.6, 24.3, et al.; M^1 makes the necessary corrections, proving its value.[7]

MIXED TRADITIONS:

The four remaining manuscript groups--VUQZ--all have contaminated recensions in that they copy their versions of the treatise from more than one source.

V:

Jan thought V worthy of great consideration, but V is easily shown to be worthless for establishing the text; it offers only a few

interesting conjectures or variants. V(28) shares numerous conjunctive errors with M; cf. 1.1, 2, 5, 7, 8; 3.4, 8; 4.4; 6.1, 9; 7.25 (bis); 8.10, 11; 9.8, 18; 12.4, 6, 11, 14, 15; 13.1, 2(bis), 3(bis), and so forth. But V also reveals some separative errors not found in M--7.7, 8.19, 21.6, 22.14, 23.19, and 25.1f.--by which V is shown to be dependent upon M. On the other hand, V shares a reading with PC against M that cannot be overlooked. At 8.22 PC admit the list of diatonic ("movable") notes; cf. 8.9. All the other scribes omit this passage, perhaps for paleographical reasons, perhaps for musicological reasons.[8] Clearly, V is partially derived from some member of PC as well as from M. Specifically, V shares readings with P against MC at 12.9 and 23.19, whereas V shares readings with C (or C^1) against MP at 11.20(C), 14.12(C^1), 21.1(C), and 21.6(C), but none of these readings should actually be considered a "significant" error. So although V's exact second source is beyond discernment, V's testimony can nonetheless be eliminated as a contaminated version of M and PC. The only readings of interest in V found in the apparatus criticus are these:

12.11 ἐτέρου

17.6 εἰ ἡ

20.20 δε οὖ τρίτον--δεύτερον δε]δεύτερον δε, πέμπτον

22.6 ante ὑπερβολαίων add. τοῦ

23.20 ὀξύτονον (unum verb.)

26.9 βαρύτατος] ὀξύτατος

It is possible, however, that V's source was not necessarily a later version of MPC, but a version contemporary with MPC and derived from the same archetype. Nonetheless, V in its present form is virtually

useless to us.

In turn, 44 is clearly derived from V; there are significant errors where 44 and V are separated from the rest of the tradition, e.gg. 7.7, 8.19f., 9.9, 10.6, 13.3, 13.8, and 14.4, but 44 also contains readings not shared by V, e.gg. 18.2, 18.18, and 23.6. Not only is 44 contaminated with V and U (see infra), e.gg. 23.6, 23.21, 24.14, 26.1, and 28.4, but it makes numerous orthographic mistakes; its testimony is worthless.

U:

By far the most numerous and most complicated grouping of the manuscripts attributed to Euclid are the U-type manuscripts. Jan recognized L(12) as a manuscript of importance for the Εἰσαγωγὴ ἁρμονική and he also recognized its close relationship to U(46); but he erred in neglecting the readings of another manuscript, S(27), which also belongs to the "UL-type." The manuscripts which belong to this group are these: 1, 2, 6, 7, 12(L), 17, 20, 21, 22, 23, 27(S), 37, 41, 42, and 46(U). These include all the manuscripts attributed to Euclid which do not derive from V (i.e. 44) and which do not include the Aristides Quintilianus interpolations (i.e. Q; cf. infra, p. 91f.). All are relatively late; three are fifteenth century (20, 42, 46), one is late fifteenth or early sixteenth (12), the rest are sixteenth century or later. Their readings reflect the frenzied effort of that period to compare and correct manuscripts. They are all so interconnected, corrected, and yet contradictory that there are only three common, unique variants by which a member can be immediately identified: 2.19 add. διαστήσεις, 10.7 add. ὑπάτης, and 12.15 add.

ἀσύνθετον διάστημα.[9]

Here follows a list of significant variants of the U-type manuscripts:

	1	2	6	7	12(L)
1.5f	ἔχον	ἔχων	ἔχον	ἔχων	ἔχον
2.19	τιθεῖται	τεθεῖται	τιθεῖται	τιθεῖται	τιθεῖται
2.19f	add. διαστάσεις	add.	add.	add.	add.
3.2	ὀξύτης βαρύτης	ὀξύτης βαρύτης	ὀξύτητι βαρύτητι	ὀξύτητος καὶ βαρύτητος	ὀξύτητι τος βαρύτητι
4.13	νήτη (τρίτη in marg.	τρίτη	νήτη; τρίτη in mg.	τρίτη	νήτη
4.16	add. συνημ. corr. in marg.	add. συνημ. corr in mg	add. συνημ. corr. in mg	παραμέση παραμέση συν.	non add.
5.25	μέση; -ων supra	μέσων	μέσων	μέσων	μέση
6.7	add.; corr. in marg.	add.; corr in marg.	add.; corr in marg.	hab. corr.	hab. corr.
9.16f	hab.	hab.	hab.	hab.	hab.
10.2	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι
10.7	add. ὑπάτης	add.	add.	add.	add.
11.19	add. τόπους	add.	non add.	add.	add.
12.15	add. ἀσύνθ. δ.	add. ἀσύνθ. δ.	add. ἀσύνθ. δ.	add. ἀσύνθ. δ. in mg.	add. ἀσύνθ. δ.
12.15	--	--	δίεσιν in mg.	δίεσιν	δίεσιν in mg.
15.5	add. καὶ διαφώνου	add. καὶ διαφώνου	add. καὶ διαφώνου	add. καὶ διαφώνου	om.
16.17	add. καλούμενον	add. καλ.	add. καλ.	add. καλ.	non add.
17.5	συγκειμένων	-μένων	-μένων	-μένων	-μενα
20.17	ἕβδομον	ἕβδομον	ἕβδομον	ἕβδομον	πρῶτον
28.4	διαστηματικοῦ	διαστημ/κοῦ	διαστημ/κοῦ	διαστημ/κοῦ	διαστημ/κοῦ

	17	20	21	22
1.5f	ἔχον	ἔχον	ἔχον	ἔχον
2.19	τιθεῖται	τιθεῖται	τεθεῖται	τιθεῖται
2.19f	add.	add.	add.	add.
3.2	ὀξύτης καὶ βαρύτης	ὀξύτης βαρύτης	ὀξύτης βαρύτης	ὀξύτητι βαρύτητι
4.13	τρίτη	τρίτη (νήτη in mg.)	νήτη (τρίτη in mg.)	νήτη (τρίτη in mg)
4.16	non add.	add.	non add.	add; corr. in marg.
5.25	μέσων	μέσων	μέσων	μέσων
6.7	habet corr.	hab. corr.; add. in mg.	add.	add, corr. in mg.
9.16f	habet	om.(-9.18) habet in mg.	add.	add., corr. in marg.
10.2	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι	μὴ ὥστε ἢ καθαρθῆναι
10.7	add.	add.	add.	add.
12.15	add.	add.	add.	add.
12.15	δίεσιν in mg.	δίεσιν in mg.	--	--
15.5	add.	add.	add.	add.
16.17	add.	add.	add.	add.
17.5	-μένων	-μένων	-μένων	-μένων
20.17	ἔβδομον	ἔβδομον	ἔβδομον	ἔβδομον
28.4	διαστηματικοῦ	διαστηματικοῦ	διαστηματικοῦ	διαστηματικοῦ
11.19	add.	non add.	non add.	non add.

	41	42	46(U)
1.5f.	ἔχον	ἔχον	ἔχον
2.19	τιθεῖται	τεθεῖται	τιθεῖται
2.19f	add.	add.	add.
3.2	ὀξύτητι βαρύτητι	ὀξύτης βαρύτης	ὀξύτητι της βαρύτητι
4.13	νήτη (τρίτη) in mg.	τρίτη	νήτη
4.16	add.	non add.	add.
5.25	μέσων	μέσων	μέση, -ων supra
6.7	add.; corr. in mg.	habet corr.	add.; corr in mg.
9.16	hab.	om.	hab.
10.2	μὴ ὥστε ἢ καθαρθῆναι	μὴ οἵων τε καθῆναι	μὴ ὥστε ἢ καθαρθῆναι
10.7	add.	add.	add.
11.19	non add.	non add.	add. supra
12.15	add.	add.	add.
12.15f	δίεσιν in marg.	--	δίεσιν in marg.
15.5	add.	add.	add.
16.17	add.	add.	add.
17.5	-μένων	-μενα	-μένων
20.17	ἔβδομον	ἔβδομον	ἔβδομον
28.4	διαστηματικοῦ	διαστηματικοῦ	διαστηματικοῦ

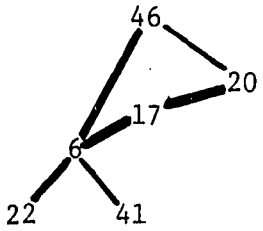
The interdependent tangle of marginal corrections and textual errors makes a complete stemmatic analysis of this sub-group difficult. None of the manuscripts here is clearly outstanding. U, for example, which will be shown to be the source of all the other members of the group, contains numerous errors; 12(L) corrects U often, e.gg. 16.17, 17.5, and 20.17, and yet this same L also presents idiotic ("idiotic" because the correct readings are so predictable) readings at 4.13 and 5.25. Elsewhere the marginal corrections complicate analysis with conflicting data.

Nonetheless many relationships are clear enough. 6, 22, and 41 have matching folios and share the exact same variants except for the fact that 22 terminates all marginal additions at p. 324 (at 9.4) and 41 at f. 124^{r} (at 22.1). Neither 22 nor 41 can be eliminated as incomplete versions of 6 or of the exemplar of 6. for it is only in the preservation of the marginalia that they differ. We should probably consider 6, 22, and 41 as gemelli of the same exemplar; cf. also infra, pp. 106. The original text of 6, 22, and 41 seems to have been derived from an uncorrected 46; cf. especially 3.2, 4.13, 4.16, and 6.7. The divergencies at 5.25 and 11.19 are easily discovered corrections. The marginal variants of 6, however, derive from the text of 16--possibly its corrective, comparative copy; cf. 4.13, 4.16, 6.7 (and 12.15).

46 sought a corrector who must have read ὀξύτης βαρύτης at 3.2, μέσων at 5.25, corr. at 6.7, and δίεσιν at 12.15. These readings are all found in 20, which is, like 46, a fifteenth-century manuscript. There are readings in 20, however--4.13, 6.7, and especially 9.16f--which prove that 20 cannot have been the corrective copy of 46, for

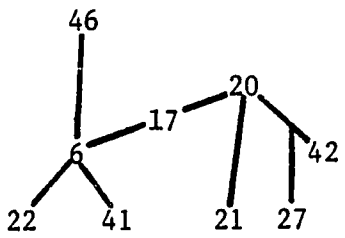
why would 20 have three incorrect readings added to its margins? 20 must derive from 46, and it made an easy correction at 4.13 and followed 46's corrections at 3.2, 5.25, 6.7, and 12.15. 20 contains 46's original readings in its margins. As for the corrector of 46, there are no other fifteenth-century manuscripts extant other than 42, which is inferior; cf. 9.16.

17 contains many readings corrected from 46 or found in the text or margins of 20--3.2, 4.13, 5.25, 6.7, 9.16, and 12.15--and 17 is therefore either a corrected copy of 46 or in all likelihood of 20.

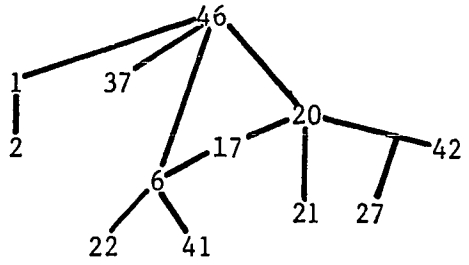


At 9.16f. three manuscripts--21, 27(S), and 42--make the most serious omission found in these U-type manuscripts; the omission, which harms the syntax, is due to the repetition of τεσσάρων. These three manuscripts also share significant conjunctive errors at 2.19, 9.5, and 11.19. They differ among themselves where 21 has marginal corrections at 4.13, adds the incorrect readings at 6.7 and 17.5, and has μὴ ὥστε ἢ καθαρθῆναι at 10.2; since 27 and 42 always agree (at least in the variants listed in the preceding chart), 21 represents a contaminated version of 27 and 42. One then assumes 20 and 21 to be related since they both abbreviate τρίτη (4.13) as $\overline{\Gamma}$ and then add νήτη in the margins. Also, 21 takes many of its divergencies (from 27 and 42) from 20's model, 46, egg. 6.7, 17.5, and 10.2. Where 21 and 20 differ, 21 is shown to be a poorly corrected copy of 20; cf.

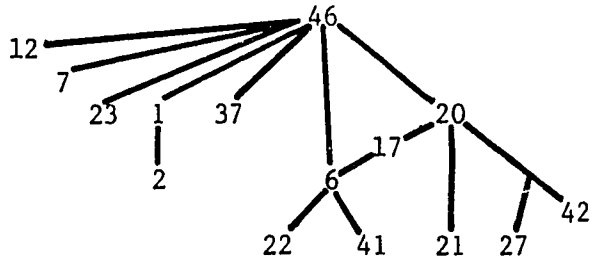
4.13, 9.16, and 11.19. Yet the following information shows this relationship to be temporally complicated, for 21's omission at 9.16 must have been copied by 27 and 42; we know 27 and 42 copied from 21 rather than 21 from 27 and 42 because 21 preserved the original reading at 10.2 while 27 and 42 have an emendation. The problem here is that 42 and 20 belong to the fifteenth century, 27 and 21 to the sixteenth. Nonetheless, of 27 and 42, 42 is the earlier, but 27 is clearly superior in that it does not commit omissions (2.17 τας, 17.1 δις δια πασῶν) or errors (12.3 μεν]μέση) as readily as 42. Jan used 42 instead of 27, and this is why he incorrectly attributes the readings found in S(27) at 10.1 to Meibom and Pena instead of to the manuscript tradition.



46 shares conjunctive errors with 1, 2, and 37; cf. 3.2. 2 is clearly dependent upon 1, mistakenly writing ἔχων for ἔχον (1.5f.) and τεθεῖται for τιθεῖται (2.19) and using the marginal corrections of 1 at 4.13 and 5.25. Similarly, 1 and 37 share the readings which derive from 46, e.gg. 3.2, 4.13, 6.7, but 37 does not add the (correct) marginal variants found in 1. These marginal variants in 1 still derive in all probability from 46 (cf. 4.13 and 6.7), but 1 omits the addition of δίεσιν at 12.15. 2 and 37 also omit this addition, as do 27 and 42 and therefore 21. Its inclusion in 46 is responsible for its appearance in 20, 6, 17, and 41; 22 omits it because its marginal additions are abruptly halted at 9.4.



There are still three remaining manuscripts--7, 12, and 23. 12 has obviously been corrected (3.2) and is itself a corrected version of 46 which has corrected U at 4.16, 6.7, 16.17, and 20.17, but misread U at 3.2.[10] 12(L) maintains U's obvious errors at 4.13 and 5.25. Otherwise, these three manuscripts are incapable of specific stemmatic analysis. At 3.2, 23's reading resembles exactly that of 12(L), for both read ὀξύτητι βαρύτητι with -τος suprascript. But if 23 (τρίτη) corrects 12's νήτη at 4.13, it adds the nonsensical material at 6.7 and that at 15.5 and 16.17, and it completely disagrees at 17.5 and 20.17. Nor can 12 be copied from 23 since 12 would have erred in changing μέσων to μέση(5.25) and τρίτη to νήτη (4.13). 23 and 12 must be gemelli indirectly descended from 46.[11] Neither 7 nor 23 offers any original or valuable readings, but some of the corrections in L are of interest.



Jan gave 12(L) and 46(U) their own sigla, but L is derived from U, and so they cannot be regarded consistently as two separate

branches of the tradition. Only where L has useful or intriguing conjectures will it be cited, e.g. 24.14. Also, where warranted, e.g. 27's emendation at 10.1 for the apparent lacuna, the readings of 27 will be designated as S.[12]

The exact sources of U are not perfectly clear, although it is certainly safe to assume that U is derived only from an extant part of the tradition, i.e. MM^1CP. Only a portion of the readings in U are to be found in the apparatus. The corrections in M compare with the readings in the manuscripts of U and its descendents: 1.1-2, 3.4, 3.5-6, 6.1, 7.6(not LS), 8.10-11, 9.8(not S), 9.18, 10.6, 12.15, 13.2, 13.8, 14.4, 14.12, 15.5(not L), 18.6, 18.7, 18.13, 20.14, 20.15, 22.2, 23.6(not LS), 23.8(not S), 26.1, 26.11, 26.12, and 28.4. The elimination of L and S leaves only U which preserves the readings in M^1 unchanged. Moreover, U in general shows separative errors against M^1 at 8.19, 8.21, 11.21, 12.4, 18.6, and, especially, 12.10, where the corrections of M^1 are not the same readings as those in U. In each of these separative errors the reading in U is found in M instead of M^1. It appears that U and the corrected M are related. If Jan correctly dated the marginal corrections in M to the twelfth, fourteenth, and fifteenth centuries, it may well be that U derives from the corrected M; our earliest extant manuscripts of U-type manuscripts belong to the fifteenth century. On the other hand, it has already been pointed out how it is unknown whether M^1 derives its corrections from other manuscripts of U-type or vice versa, but with the evidence supplied here it seems probable that U is based on a copy of the corrected M. Since M^1 attributed the (anonymous) treatise to Euclid, this connection between M^1 and U would explain the Euclidean

attribution in U, the proliferation of which occurred in the sixteenth century. It would also explain why there are no representatives of U-type manuscripts pre-dating the fifteenth century, for, if Jan is correct, the last corrections in M were made in the fifteenth century. Lastly, da Rios (lxxxvif.) discerns the hand of Rhosus, the copyist of U, in M. On the other hand, see infra, pp. 94f, where Z derives from U, and Z certainly belongs to the fourteenth century.

Besides U's dependence on the corrected M, U is also found to share (reasonably) significant readings with P at 4.13 and 18.18, with C at 4.11 and 4.14, and with CP at 6.15 and 7.25. It is tempting to try to trace U's readings of MM^1CP back through V and thus suppose U to have derived from V and not from a few different sources.[13] But neither U (nor any U-type manuscript) includes the vital "movable" diatonic passage at 8.22 which is to be found (only) in VCP; more importantly, V shares absolutely no readings with M^1 against M, and U certainly shares numerous readings with M^1. Lastly, though V derives partly from some form of CP, the only readings shared by UCP at 4.11, 4.13, 4.14, 7.25, and 18.18 are not found in V.

Q:

Q-type manuscripts consist of three manuscripts attributed to Euclid--26, 33, 34--as well as three "Anonymous" manuscripts--14, 16, 18. Q-type manuscripts are distinguished by the insertions made from Aristides Quintilianus and Bryennius. I use Q as a siglum as a reminder of the Quintilianus additions. All six of these manuscripts cease transmission of the treatise at 29.7 (φωνῆς) and then add a passage from Aristides (28.10-30.17). They all add other passages

from Aristides and Bryennius at the following points in the treatise:

post 7.15 (ὑπερβολαίων) add. A.Q. 8.3-9.12

post 8.21 (χρωματική) add. A.Q. 9.15-10.15

post 12.11 (δίτονον) add. A.Q. 12.6-12.8

post 29.7 (φωνῆς) add. A.Q. 28.10-30.17

post 9.20 (βαρύτητι) add. Bry, 100.14-100.21

post 11.6 (ὅμοια) add. Bry. 102.19-102.20

A list of significant errors in each of the six manuscripts shows that those attributed to Euclid (26, 33, 34) share readings against those attributed to Anonymous (14, 16, 18); this is a conclusion one might have expected.

	14	18	16	26	33	34
1.1	Ἀνωνύμου	Ἀνωνύμου	Ἀνωνύμου	Εὐκλείδου	Εὐκλείδου	Εὐκλείδου
1.5	ἔχον	ἔχον	ἔχων	ἐχόντων	ἐχόντων	ἐχόντων
1,8	τόνων	τόνων	τόνων	τόνου	τόνου	τόνου
1.9	φθόγγων	φθόγγων	φθόγγων	φθόγγου	φθόγγου	φθόγγου
2.1	γένος om.	transp.	transp.	transp.	transp.	transp.
3.9	om.	hab.	hab.	hab.	hab.	hab.
4.4	μεν οὖν	οὖν	οὖν	οὖν	οὖν	οὖν
5.1	δὲ χρώματι	δὲ χρώματι	δὲ χρώματι	δὲ τῷ χρώματι	δὲ χρώματι	δὲ χρώματι
5.15	διεζευγμένων	διεζευγμένων	διεζευγμένων	συνημμένων	συνημμένων	συνημμένων
21.18	μέση ὀξυτάτη βαρυτάτη	μέση ὀξυτάτη βαρυτάτη	μέση ὀξυτάτη βαρυτάτη	βαρυτάτη μέση ὀξυτάτη	βαρυτάτη μέση ὀξυτάτη	βαρυτάτη μέση ὀξυτάτη
26.12	τριημιτονίῳ	τριημιτονίῳ	τριημιτονίῳ	om.	om.	om.

14 derives from 18; it reveals dependent errors at 2.1, 3.9, and 4.4. 16 contains many conjunctive errors with 18 and was copied later than 18. The lack of independent, separative errors in 16 therefore makes 18 the only manuscript of these three worthy of further stemmatic investigation.

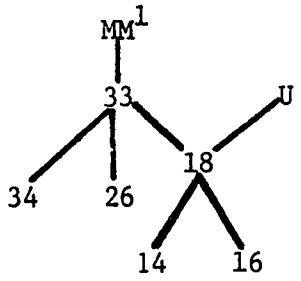
33 once belonged to Orsini and dates from as early as 1400; it easily predates 34 and 26. A significant separative error in 34 against 33 is its omission and then marginal addition of 33's text at 5.21-6.10. 26 misspells 33's εἴκοσι τεσσάρων (14.20) as one word, εἰκοτεσσάρων, and it shows other obvious dependencies as well. 33 must stand as the lone representative of this triad.

The separative errors at 5.15, 21.18, and 26.12 do not help to clarify the relationship between 18 and 33; they are all the result of conscious textual manipulation. On the other hand, 18 shares the significant errors at 1.3 (τε om.), 13.5 (κέκληνται), 16.17 (add. καλουμένον), 18.20-19.3 (hab.), 23.20 (hab.), and 28.20 (hab. perfossum) with U against 33. 18 has been interpolated from ᾶ representative of U, and so its value in determining the readings of this group is undermined. Moreover, 18 makes omissions at 2.15 (ἤ), 14.2 (και), and 21.1 (και) which 18 does not omit. The readings of Q are to be found in their purest state in 33.

When the readings of Q are read against those of $M(M^1)$, Q can be shown to be dependent upon some version of them. No significant separative errors are present which might suggest Q's independence, since all of Q's individualized readings are clearly (usually intelligent) conjectures, e.gg. 8.9 (add. ὄπυκνοι), 9.20 δυοῖν for δύο), 12.10 (add. τεταρτημόριον τόνου), 20.20 (ἔβδομον), and 23.6

(μέσης ἐπὶ παραμέσην). The scribe of Q (or its archetype) possibly had some previous acquaintance with Greek musicology. Besides the interpolations from Aristides Quintilianus and Bryennius, at 6.15-18, 6.20-22, 7.1-3, and 7.7-9 he shows his impatience with writing out the full names of the notes, substituting λιχανὸς μέσων διάτονος, χρωματική, ἐναρμόνιος for the regular λιχανὸς μέσων διάτονος, λιχανὸς μέσων χρωματική, λιχανὸς μέσων ἐναρμόνιος. Where M makes an omission Q often avoids the difficulty and omits the entire sentence, e.gg. 10.1 and 18.20-19.3. Another possibility, however, is that Q merely copied the corrected M which contains excerpts from Aristides in its marginalia.[14] Q certainly does not follow the original M alone, for Q shares significant errors with M^1 at 1.2, 9.8, 15.5, 18.7, 18.18, and 26.1. (Q, however, seems to share a significant error with U (ἕβδομον) against M^1 (πρῶτον) at 20.17, which would show that Q is derived from M^1 through U.[15]

A stemma of Q-type manuscripts would probably appear in this way:



The apparatus criticus of my edition offers only the more useful and intelligent emendations of Q(33). Occasionally good conjectures or scholia in individual manuscripts of Q-type--Vat. 1346(34), Paris Supp. 449 (26), or Neap. 260 (ff. 16^r- 21^r) (18)--are listed in the apparatus. These points include 1.1, 1.9, 4.4, 7.17, 8.12, 14.21, 15.1, 21.10, 24.14, and 29.7. Lugdunensis Periz. F. 41 is cited at 28.4.

Z:

Two manuscripts attribute the treatise to Zosimus--15 and 40. Two others, 29 and 32, belong to the same group although they do not have the attribution to Zosimus. 15 belongs to the fourteenth century, 29 to either the fourteenth or thirteenth, and the other two to the sixteenth century. The Z-type manuscripts are defined by the following conjunctive variants:

3.3 ante δι' add. διάφερον

5.24 λιχανὸς ὑπάτων om.

5.28 μέση om.

10.9 μέση καὶ νήτης om.

12.3f. ἡ τοῦ βαρυτέρου τὸ τῶν τετραχόρδων περιεχόντων δίτονον ἀπέχουσα ἀπὸ τῶν τετραχόρδων περιεχόντων

21.12 διοίσει ὁμοίως συστήματα

29.5 γενομένη

The two oldest manuscripts, 15 and 29, display the following separative errors:

	15	29
2.18	ἑναλλὰξ	ἑναλὰξ
7.12	παρανήτη ὑπερβ. ἑναρ.	om.
7.13	παρανήτη ὑπερβ. χρωματική	χρωματική
12.7	μία	μίαν
14.8	διέσεων	διαιρέσεων
15.5	συμφώνου	σύμφωνον
22.1	μέσων	μέσον
24.11	ἀοιδὰν	αὐδὰν
24.16	ψάλλον	ἔψαλον
26.11	βαρυτάτου / μέχρι	βαρύτατα / ἄχρι

15 clearly represents a superior version of this branch of the tradition. Jan ignored 15 in establishing his text and apparatus, thinking that 29 (his W) could predate 15, but W must be removed from the apparatus; even if 29 were to predate 15 as a codex, its version of the Z-archetype is inferior to that which is presented in 15.

15 and 40 share an essential conjunctive error in attributing the treatise to Zosimus, although neither 15 nor 40 entitles the work Εἰσαγωγὴ ἁρμονική; instead, 15 reads Περὶ ἁρμονικίας, and 40 Ἐπὶ ἁρμονίας. The following sample of significant variants:

	15	40
10.5	ὑπὸ	ὑπὲρ
14.22	δc	δ
16.21	αὔξει	ἔξει
28.18	κεχρῆσθαι	κεκρῆσον

shows that 15 is undoubtedly superior to 40.

15, 29 and 40 do not comprise all the manuscripts of the Z-tradition. A fourth member of the group, 32, seems to be attributed to Euclid, but the entire treatise is actually omitted until 29.10. Here there is the title Εἰσαγωγὴ ἁρμονικὴ Εὐκλείδου, and the next word, δύναμις, begins with a capital delta. Similarly, ἐστι (29.10) is transposed until after συστήματι, and φθόγγων is read for φθόγγου. In 29.14 τὸ is omitted. All these characteristic variants are found in the Z-type manuscripts--even the second attribution to Euclid at 29.10.[16] 32 is clearly a member of this group. Ultimately, 15, not Jan's W, serves as the lone representative of Z-type manuscripts.

The man responsible for the Z-archetype had an inept yet sincere desire to establish a useful text of the Εἰσαγωγὴ ἁρμονική

Countless conjectures, additions, and emendations fill our representative manuscript, but often the musicology or grammar of Cleonides will just not tolerate these suggestions and changes. Examples of such ineptitude and of oversimplified emendations and additions can be found at:

1.8 περὶ μεταβολῆς om.

3.3 ante δι' ἐπιτάσεως add. διάφερον

3.7 ante τάσεις add. αἱ

3.8 παρὰ]περὶ

4.18 παρανήτη]νήτη

5.28 om.

6.5 τρίτη]νήτη

11.1 ὁμοίως]ἀνάπαλιν

14.4 ἑλύεται]διατήκεται

16.12 διάτονον om.

19.6 ἔστι δὲ]ἤ

20.21 τρίτον]πρότερον

29.10 φθόγγου]φθόγγων

Conjunctive and separative errors reveal Z's dependence on a U-type text, and yet 15 (fourteenth century) predates U(46). Nonetheless the fifteenth-century U is superior to 15, and so 15 must depend on a U-prototype; cf. the conjunctive errors at:

2.19 post τὰς δὲ add. διαστάσεις

3.8 καθαπτῶν]καθ' αὑτῶν

4.15 νήτη συν. om.

4.16 παραμέση]παραμέση συνημμένων

5.25f μέσων]μέση

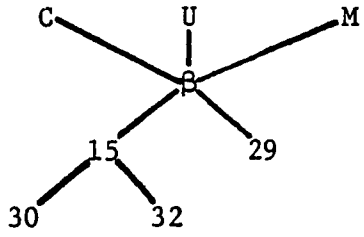
13.3 add. ἑπτὰ μὲν ἡμιτόνιον

and numerous separative errors.

At the same time, Z shares a number of significant readings with MC against U:

	15	U	MC	
17.11	ὑπάτων	ὑπάτων	ὑπάτων	(MP)
17.13	ὑπάτων	παρυπάτην	ὑπάτην	(MC)
20.8	ἤ	ἐπὶ	ἤ	(C)
20.15	τε καὶ	μὲν ἐπὶ τὸ βαρὺ	τε καὶ	(MCP)
20.19	πρῶτον	τέταρτον μὲν	πρῶτον	(MP)
22.15	σύμφωνον	συμφώνῳ	σύμφωνον	(MC)
23.12	τῶν	τὸ	τῶν	(MC)
26.1f	om.	hab.	om.	(C)
27.17	om.	hab.	om.	(MCP)

Z is therefore dependent upon three branches of the tradition--M, C, and U--and has no independent value. A stemma of Z-type manuscripts will appear as follows:

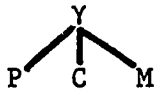


THE ANONYMOUS MANUSCRIPTS:

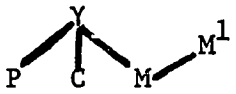
Seven manuscripts have no author attribution: 8, 11, 28, 29, 30, and 47. 8 and 11 have been ascribed to P-type manuscripts; 29, Jan's W, was shown to be an inferior version of Z; 30 was found to be a member of the C-type manuscripts. Jan used 28 as his V, and 47(M) had an attribution to Euclid added by a correcting hand (M^1).

THE STEMMATIC BASIS FOR THE TEXT:

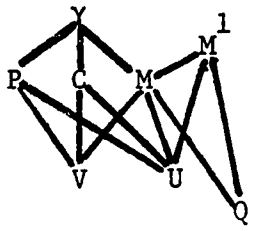
All the evidence available to us at the present suggests that an exemplar (γ) of the Εἰσαγωγὴ ἁρμονική became available or desirable in the twelfth century, at which time C, P and M were copied; MC seem to be more closely related to each other than either is with P.



At some as yet undatable time(s) between the twelfth and fifteenth centuries, M was corrected by possibly several hands (M^1) which (or one of which) attributed the treatise to Euclid. It is not possible to determine if this M^1 had access to a copy contemporary with or earlier than γ, (but the Euclidean attribution suggests a connection with the Arabic part of the tradition; cf. <u>infra</u>, p. f.).

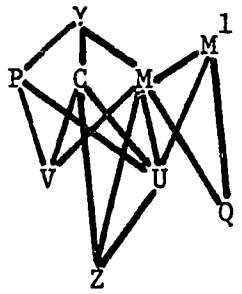


Numerous copies were then made from MM^1CP; V was derived from MCP (and thus not originally attributed to Euclid); U was derived from MM^1CP; and Q was derived from MM^1. The latter two were both attributed to Euclid.

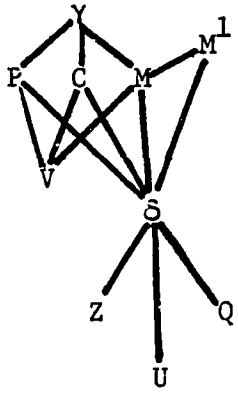


Then one group, Z, copied from U, confusedly attributing the treatise

to Zosimus and also borrowing readings from MC.



If it were to be true that U derived the attribution to Euclid from M^1 in the fifteenth century, Z (fourteenth century) would not be able to be derived from U (fifteenth century) unless a twelfth to fourteenth-century copy of the treatise derived from MM^1CP much as U does, but without the attribution to Euclid. In this case Z would derive from MM^1CP independently of U and would still have readings similar to those in U. Then in the fifteenth century a later corrector of M added the Euclidean attribution which U was to copy shortly thereafter.



Q, possibly of the fourteenth century, would then necessarily belong to the fifteenth century; it, with U, might also derive from this Ŝ.

The text which follows has been established from MCP with their correctors $M^1C^1P^1$, with several conjectures or corrections from ULS: $MCP(M^1C^1P^1)$ are found to be deficient at 12.9, 12.14, 12.15,

17.6, 18.17, 20.22, 21.10, 21.12, 26.11, 28.4 (and 6), 29.8f. VZQ are found in the apparatus where their variants are paleographically or musicologically interesting (e.g. 12.3) or exegetical (e.g. 8.12); cf. 24.7.

One rudimentary caveat must accompany this introduction to the text, and that is that the editor of the Εἰσαγωγὴ ἁρμονική must distinguish between the words Cleonides wrote and the words Cleonides might have written. It is extremely tempting for the editor of Cleonides, be he Byzantine or of the twentieth century, to make the treatise as musicologically clear and pedagogically effective as possible; one would easily add examples, parallel phrases, forms of εἶναι, particles and the like to clarify the text, but a responsible codical analysis will not permit U's addition of ἐστι at 1.4, Z's addition at 3.5, M^1's extra examples at 9.8, 9.9, and 9.18, or any other such changes of the original text no matter how much more lucid they render the text. For the Byzantines, to make the treatise a used and useful manual was the chief purpose of making a copy;[17] for us it is to seek out and try to reestablish Cleonides' original text. Exegesis and commentary belong in the commentary and apparatus, not in the text.

Putting this basic principle into practice can result in some difficult choices: Does the manuscript tradition omit the words of Cleonides which are then restored by a later conjecture? Are words which are found in only some of MM^1CP omissions or additions? It is never easy to distinguish; Cleonides' style is so peripatetic, colorless, and predictable that it is easy for us to add to his text. The matter is far different for the editor of Euripides or Pindar who has many works with which to compare and who has a definitive style within

which to work. This is our only work by Cleonides, and it was the type of work which Byzantine copyists and scholars did not hesitate to emend or "improve." On the other hand, since the Εἰσαγωγὴ ἁρμονική is essentially a manual, the addition of a few words or sentences to the original text is not nearly so serious an intrusion as it would be in the fragile, individualized poetry of a Euripides or Pindar.

MUSICOLOGICAL TREATISES AND THE CODICES:

The variety of author attributions gave the Εἰσαγωγὴ ἁρμονική a relatively unique place among ancient treatises--to be included twice within several (eight) different codices: Bononinsis gr. 2432 (Pappus(P), Cleonides(C)); Florentinus Riccardianus gr. 41 (no attribution(P), Cleonides(C)); Neapolitanus gr. 260 (Anonymous(Q), Cleonides(C));Parisinus gr. 2460 (Euclid(U), Pappus (P)); Vaticanus gr. 191 (Euclid(V), Euclid(Z)); Vaticanus gr. 2338 (Cleonides(C), Pappus(P)); Vaticanus Barnerinus gr. 265 (Pappus(P), Cleonides(C)); and Vaticanus Urbinas gr. 77 (Euclid (VU), Pappus (P)). In each of these eight codices but one (Vat. 191) the treatise is attributed differently within the same codex, and in every codex each of the two copies of the treatise belongs to a different manuscript group. Once, two versions (P and C) of the treatise are even juxtaposed--Vaticanus Barberinus gr. 265, pp. 300-310, 311-18.

More often than not--twenty-six times--the treatise is followed directly and occasionally without even so much as a two-centimeter space by Euclid's Sectio Canonis: 1, 2, 4, 5, 6, 7, 12, 15, 17, 20, 21, 22, 23, 27, 28, 29, 30, 35, 37, 38, 41, 42, 43, 44,

46, and 47; all of these manuscripts belong to MCU(Z). This juxtaposition can occur even when the Εἰσαγωγὴ ἁρμονική and Sectio Canonis are not both attributed to Euclid: 4, 5, 15, 28, 29, 30, 35, 39, and 43--all MC manuscripts. There are only three codices--Berolinus Phillippicus gr. 1552, Vaticanus gr. 191 and 671 (U, VZ, P)--which contain any of Euclid's non-musical works, and so it is quite evident that the Εἰσαγωγὴ ἁρμονική was widely regarded first as a musicological treatise and only secondarily as a Euclidean treatise in the late medieval period. There are, however, codices which contain a number of non-musical treatises along with the Εἰσαγωγὴ ἁρμονική. The distribution of musical and non-musical treatises within each codex can be seen in the charts which follow on the next pages. In many codices the Εἰσαγωγὴ ἁρμονική is immediately followed by Euclid, Aristoxenus, and then Alypius; and in some manuscripts (U-type) Alypius is then followed by Gaudentius and Nicomachus:

Cleonides, Euclid, Aristoxenus:

Berolinus 1552
Vaticanus 191
Vaticanus Reg. 94
Vaticanus Urb. 77
Venetus Marc. VI/3 (M)

Cleonides, Euclid, Aristoxenus, Alypius, Gaudentius, Nicomachus:

Bononiensis 2048
Escorialensis X-I-12
Lipsiensis 25 (L)
Monacensis 104
Oxoniensis 41
Parisinus 2456
Parisinus 2457
Vaticanus 2365
Venetus Marc. 322 (U)

In some of these codices Nicomachus is then followed by Ptolemy: 7, 20, 21, 22, and 46 (all U-type). Where Ptolemy is found,

CODEX		TYPE	Cleonides (two versions)	Euclid	Aristoxenus	Alypius	Gaudentius	Nicomachus	Aristides Quin.	Bryennius	Bacchius	Ptolemy	Porphyry	Plutarch	Bacchius	Ptolemy	Aristotle	Theon	Anonymous Bell.	Psellus	Aristox. Rhyth.	non-music Euclid	other non-music
1	Berlin 1552	(U)	x	x	x			x		x							x					x	
2	Bonon 2048	(U)	x	x	x	x	x	x	x	x		x	x	x								x	x
3,4	Bonon 2432	(CP)	x	x	x	x	x									x		x					x
5	Cantab. 1464	(C)	x	x																			
6	Escor. Φ-II-5	(U)	x	x	x	x	x	x	x	x				x									
7	Escor. X-I-12	(U)	x	x	x	x	x	x	x	x			x	x									
8,9	Flor. Ricc. 41	(CP)	x	x		x		x								x		x	x				x
10	Hamburg 109	(P)	x				x	x			x				x			x					
11	Haun. 1871	(P)	x				x	x										x					
12	Lipsiensis 25	(L-U)	x	x	x	x	x	x	x	x													
13	Lond. BM 27863	(C)	x							x													
14	Lugdun. Per F41	(Q)	x						x														
15	Matrit. 4678	(Z)	x	x																		x	
16	Mediol. Am 768	(U)	x		x	x	x	x	x	x	x	x	x	x	x	x							x
17	Monacen. 104	(U)	x	x	x	x	x	x	x	x													x
18/9	Neapol. 260	(QC)	x	x	x	x	x						x										x
20	Oxon Bodl. 41	(U)	x	x	x	x	x	x						x									
21	Paris 2456	(U)	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
22	Paris 2457	(U)	x	x	x	x	x	x	x	x	x	x	x	x	x	x							
23/4	Paris 2460	(UP)	x	x	x	x	x	x	x	x	x	x					x						
25	Paris 2535	(C)	x	x		x												x					x
26	Paris Supp 449	(Q)	x		x	x	x						x	x		x		x					
27	Upsaliensis 52	(S)	x		x	x	x			x	x	x	x				x			x			
28/9	Vaticanus 191	(VW)	x	x	x	x	x	x	x					x							x	x	x
30	Vaticanus 221	(C)	x		x	x	x	x				x	x	x	x	x		x	x				
31	Vaticanus 671	(?)	x?																			x	x
32	Vaticanus 1033	(Z)	x	x																			x

CODEX	TYPE	Cleonides	(two versions)	Euclid	Aristoxenus	Alypius	Gaudentius	Nicomachus	Aristides Quin.	Bryennius	Bacchius	Ptolemy	Porphyry	Plutarch	Bacchius	Ptolemy	Aristotle	Theon	Anonymous Bell.	Psellus	Aristox. Rhyth.	non-music Euclid	other non-music
33 Vaticanus 1341	(Q)	x																					x x
34 Vaticanus 1346	(Q)	x																					x x
35/6Vaticanus 2338	(CP)	x	x	x	x	x	x											x					x
37 Vaticanus 2365	(U)	x		x	x	x	x	x	x				x	x	x								
38/9Vat. Barb. 265	(PC)	x	x	x	x	x	x		x		x	x	x	x	x			x					
40 Vat. Otto. 372	(Z)	x																					x x
41 Vat. Reg. 94	(U)	x		x	x	x		x															x x
42 Vat. Reg. 169	(S)	x		x																			
43 Vat. Ross. 977	(C)	x		x	x	x	x		x		x				x	x		x					
44/5Vat. Urb. 77	(VP)	x	x	x	x	x	x	x	x		x	x	x		x	x		x					x
46 Ven. Marc. 322	(U)	x		x	x	x	x		x	x			x	x	x								
47 Ven. Marc. VI/3	(M)	x		x	x	x		x			x								x		x		

Porphyry's commentary is usually found as well: 7, 21, 22, 37, 38-39, 44-45, and 46. Porphyry is found without an accompanying Ptolemy in 17, 27, and 28-29.

There does not seem to be any consistent division between Aristoxenian and Pythagorean authors. Cleonides is clearly an Aristoxenian musicologist, and yet Ptolemy and Porphyry are found in twelve of thirty-nine codices, Theon in ten only four of which accompany Ptolemy or Porphyry, Nicomachus in 16 manuscripts only three of which accompany Theon and only six of which accompany Ptolemy or Porphyry, and Euclid in twenty-five codices. The latter statistic is somewhat suspect, however, on account of the frequent mistaken association between the Εἰσαγωγὴ ἁρμονική and the Sectio Canonis. In all, Cleonides is accompanied by Pythagorean treatises (not including Euclid) in twenty-six of the thirty-nine codices. This statistic would by itself be astounding, except that the preceding chart shows that the number of Aristoxenian treatises generally surpasses that of the Pythagorean treatises in each codex.

The major Aristoxenian authors are found within the same codex quite frequently. Cleonides is accompanied by at least one Aristoxenian treatise in twenty-eight of the thirty-nine codices, by at least two in twenty-five codices, by at least three in twenty-one codices, by at least four in thirteen codices, and by five in five codices. The Aristoxenian authors include Aristoxenus, Aristides, Alypius, Bacchius, and Gaudentius. Aristoxenus appears in twenty-five codices, Aristides in eighteen, Alypius in twenty-one, Bacchius in nine, and Gaudentius in twenty. It may at first seem surprising that eleven codices do not include Aristoxenian treatises, but of these

eleven, six do not contain any musical treatise other than the Εἰσαγωγὴ ἁρμονική. In spite of this, it is interesting that only once (1) do non-musical Euclidean treatises enter into the twenty-two codices which include the Εἰσαγωγὴ ἁρμονική attributed to Euclid. Nonetheless, in the Renaissance it became quite common to include a printed text of the Εἰσαγωγὴ ἁρμονική within an edition of the entire Euclidean corpus. This practice was pursued as late at 1916 when Heiberg and Menge included the Εἰσαγωγὴ ἁρμονική within their eight-volume Teubner edition of the entire Euclidean corpus.

Some predictable and some vague patterns emerge for one who investigates the codex arrangement surrounding the various copies of the Εἰσαγωγὴ ἁρμονική, and from these patterns one can glimpse the types of Renaissance interest that preserved the treatise from the twelfth to the sixteenth centuries (and which had produced seven printed editions by 1652). Our earlist codices, Ven. Marc. VI/3 and Vat. 2338 (MCP) have little overlap. M's version of the treatise introduces a series of musicological treatises--Sectio Canonis, Aristoxenus, Alypius, Aristoxenus Rhythmics, Aristides, Nicomachus, Bacchius, and Anonymous Bellermann. Vaticanus 2338 also begins with the Εἰσαγωγὴ ἁρμονική --attributed to Cleonides--and again proceeds to the Sectio Canonis; thereafter, however, follow Gaudentius, a non-musical treatise, and Theon; perhaps Theon and [Pappus] together form a mathematical unit. They are followed by Aristoxenus, [Ptolemy], and then several non-musical works. The overlap between Ven. Marc. VI/3 and Vat. 2338 is sparse, and while Ven. Marc. VI/3 contains only musicological works, Vat. 2338 contains treatises discussing the church

and other secular matters.

Another early codex, Vat. 191 contains various mathematical works--four by Euclid--followed by Gaudentius and then a series copied from Ven. Marc. VI/3. i.e. Sectio Canonis, Aristoxenus, Alypius, and Aristoxenus Rhythmics, following the Εἰσαγωγὴ ἁρμονική. But just as V shows both dependence on and independence from M, so Vat. 191 then continues with works not found in Ven. Marc. VI/3.

Of the fourteenth-century manuscripts, Matritensis 4678 (Z) contains only mathematical works followed by the Εἰσαγωγὴ ἁρμονική (Zosimus) and the Sectio Canonis, and Vat. 1341 (Q) then contains more non-musical works. Other codices which contain Q-type manuscripts are quite different. Paris Supp. 449 contains Ptolemy, Porphyry, Pappus (Commentary on Ptolemy), Theon, Gaudentius, Aristoxenus, [Ptolemy], and Alypius, while Vaticanus 1346 has astrological works, and Neapolitanus 260 has different non-musical works followed by Gaudentius, Theon, Aristoxenus, and [Ptolemy].

The later codices which contain U-type manuscripts, all of which belong to the fifteenth and sixteenth centuries, show a clear pattern of a general interest in Greek musicology in the high and late Renaissance. Nine of the codices listed above--2, 7, 12, 17, 20, 21, 22. 37, and 46--have the treatises of Cleonides ([Euclid]), Euclid, Aristoxenus, Alypius, Gaudentius, and Nicomachus, in that order. Of all fifteen manuscripts in this group, only 2, 17 and 41 have any non-musical treatises (but all these treatises in 17 were clearly added en masse after folio 239, and those in 2 belong to a separate "volume"). Of the other manuscripts of U-type, 1 adds Bryennius and Euclid's geometrical works to the canonical list and subtracts Gaudentius and

Alypius; 6 merely changes the order and adds [Plutarch] and Bryennius; 23 has the canonical six but greatly expands them by adding Anonymous Bellermann, Bacchius, Theon, and others; in fact, 23 includes thirteen different musicological treatises; 27 omits Gaudentius and Nicomachus but adds Psellus, Porphyry, Bryennius, and Aristides; and 42 contains only Cleonides and the Sectio Canonis.

It is tempting to cross-check the relationships within the manuscript tradition by codical analysis, but one can find a dead end in 22, 41, and 6; 22 has the same works as 46(U), and 6 omits three of these works; 41 omits six of them. It would thus seem that 22 was the exemplar of 6 and 41, but we have seem already (supra, p. 83) that all three are probably copied from the same exemplar; 6 and 41 contain marginalia omitted by 22.

In the codices containing C-type versions of the treatise we do not find such a similarity of treatises except that 5, 25, 35-36, and 43 each begin with Cleonides, Sectio Canonis, and that 30, 43, 39, 9 and 19--all related by variant analysis--all include Theon and Gaudentius.

Other interesting trends are these: Theon appears with every P-type codex (3-4, 8-9, 10, 11, 23-24, 35-36, 38-39, and 44-45(bis), probably by mathematical association. Anonymous Bellermann appears only in MCP codices. [Ptolemy] appears only in CQ codices. [Plutarch] appears only in U-type codices and those C codices influenced by U. And of the eight codices which contain two versions of the Εἰσαγωγὴ ἁρμονική, four contain P/C, and seven contain either P or C (and the eighth contains V which is partially derived from PC).

Chronologically one finds a general interest in Greek musicology as early as the twelfth-century's Ven. Marc. VI/3. This codex contains only musicological treatises and includes both Pythagorean and Aristoxenian authors. By the sixteenth century, scholars had access to codices such as Parisinus 2460 which contained as many as fourteen musicological treatises or Vaticanus Urb. 77 which has eighteen: Cleonides, Sectio Canonis, Aristoxenus, Aristoxenus Rhythmics, Ptolemy, Porphyry, Nicomachus, Barlaam (Commentary to Ptolemy), Theon, [Pappus], Aristides, Bacchius, [Bacchius], Hymns, Anonymous Bellermann, Alypius, Gaudentius, and Theon.

One other interesting means of examining the organization of the manuscripts and codices can be made by comparing the familial relationships established by da Rios, Winnington-Ingram, and Düring in their editions of Aristoxenus, Aristides, and Ptolemy. The results are reasonably consistent, although the double-treatment of the Εἰσαγωγὴ ἁρμονική within eight codices presents frequent difficulties.

In assembling his text of Aristides Quintilianus, Winnington-Ingram used the following manuscripts which also contain the Εἰσαγωγὴ ἁρμονική: 2, 7, 11, 12, 13, 14, 17, 19-20, 21, 22, 23-24, 37, 43, 44-45, and 46. Winnington-Ingram finds 11 and 43 to have a common parent, while I find 43 belonging to C and 11 to P; C and P are, of course, both found in the same codex, Vat, 2338, and both copies of the same archetype. Winnington-Ingram finds 46 to be the ancestor of 12, 23-24, 27, 37, 22, 2, 21, and 7, and I concur. 24, of course, is a second copy in Parisinus 2460 and it belongs to P. Naturally, 14, 26, and 33 are members of Q--with excerpts from Aristides--and are not major manuscripts for Winnington-Ingram's purposes. Win-

nington-Ingram does not recognize 33 as the archetype of the group.

Düring uses the following "Cleonides codices" in his edition of Ptolemy: 2, 7, 21, 22, 26, 28-29, 30, 37, 38-39, 44-45, and 46. Düring finds 28-29, 30, 38-39, and 44-45 to be related in his m-class, with 28-29 being superior; I also find 28(V) to be related to and superior to 44. Düring finds 2, 7, 21, 22, 37, and 46 all to be members of his g-class, with 7, 21, and 22 grouped together and 22 being derived from 21. Of the Cleonides manuscripts, 2, 7, 21, 22, and 46 were also used by Winnington-Ingram. 2, 7, 21, 22, and 37 are all derived from 46(U). Düring states that 26 is unrelated to any other Ptolemy manuscript, and 26 is a Q-type version of the Εἰσαγωγὴ ἁρμονική. Düring also states that 46 is the archetype of this subset, as I have demonstrated elsewhere.

Da Rios uses a great number of "Cleonides codices"--twenty-five codices which include thirty-three of the forty-seven versions of the Εἰσαγωγὴ ἁρμονική: 1, 2, 3-4, 6, 7, 8-9, 12, 17, 18-19, 20, 21, 22, 23-24, 26, 27, 28-29, 30, 35-36, 37, 38-39, 41, 43, 44-45, 46, and 47. She finds 35-36 (Vat, 2338) and 47 (M) to be absolutely essential codices in establishing her text, codices which also include three absolutely essential versions of Cleonides' treatise (MCP). She considers 35-36 to be the source of 18-19, 26, and 3-4, and 35-36 and 3-4 do contain CP versions of the Εἰσαγωγὴ ἁρμονική ; 18 is Q-type (19 C-type); 26 is Q-type. As I have shown, Q and CP are related indirectly through U. Da Rios finds 8-9 to be descended from 18-19, and both codices contain a C-type version of the Εἰσαγωγὴ ἁρμονική(as well as a P(8) and a Q(18)); in fact, 9 is indeed descended from 19 and 8 from 36. Da Rios finds 28-29 and 46 to be descended from 47 , and the

versions of the Εἰσαγωγὴ ἁρμονική within these codices--VW(Z)U--are indeed related to M(M^1); Z is related to M and M^1 through U, V to M and CP, and U to M^1. Da Rios then finds 44-45 to be dependent upon 28-29, and our 44 certainly derives from 28(V); it is contaminated, however, with readings from U or, as da Rios thinks, with V readings which were passed on to U.

Dependent on 46(U) for Aristoxenus are 20, 41, 37, 2, 21, 22, 6, 7, 17, and 1. Of these, Düring derived 2, 7, 21, and 22 from 46 as well, and indeed all belong to the U-type manuscripts of the Εἰσαγωγὴ ἁρμονική. Similarly, Winnington-Ingram included 17, 37, 21, 22, 2, and 7 as dependent on 46, and all of these are U-type. Only 20, 41, and 1 remain unaccounted for, and all three belong again to U-type. Da Rios also cites Jan in postulating the dependence of 12 and 23-24 on 46. Finally, she finds 38-39, 30, and 43 descended from both 47 and 35-36, and the Εἰσαγωγὴ ἁρμονική versions in these codices belong to C-type (43, 30, 39) or P-type (38, 36) which are both preserved in 35-36. 27 da Rios never examined.

Jonker, incidentally, for his edition of Bryennius, used eleven codices which contain the Εἰσαγωγὴ ἁρμονική: 1, 2, 7, 13, 17, 21, 22, 23-24, 27, 37, and 46, but Jonker never discusses their relationships. One can easily see, however, that 1, 2, 7, 21, 22, 23-24, 27, 37, and 46 again all belong to U-type, with 46 as the archetype. Only 13 (C-type) is anomalous.

NOTES

1
Two earlier manuscripts, M and V, make no author attribution, but a second hand in M, that is, M^1, and the table of contents in V (and 44, V's descendent) attribute the treatise to Euclid.

2
Jan's N apparently refers to 19 (Neapolitanus gr. III-C-2 contains two versions of the treatise), but Jan's N is not the best evidence for this group, as will be shown in my discussion of C (infra, p. 59f.).

3
For Menge's (vii) comment, see supra, p. 56.

4
At 17.11, for example, Jan cites M^3 ὑπάτην--a reading found not in N but only in P, while at 20.13 M^3's λοιρικόν is a reading found only in P^1 and C^1. Similarly, his M^4 is found only in UQ at 9.8, in PQ at 11.21, in U at 21.1, and in CPQU at 24.4; M^4 is not a helpful siglum.

5
45 has difficulty with the name "Πάπου," and 3 omits τῶν.

6
The similarity between M^1 and CP at 13.1 and 28.20 is suggestive, but 19.1 shows that all three are gemelli.

7
See also infra, pp. 96f.

8
The corrected versions of CP, that is C^1P^1, include the entire diatonic passage while VCP omit half of it--χρωματική (alterum 8.19)--συνημμένων (8.23).

9
There is one other manuscript which only apparently attributed the treatise to Euclid, Vat. 1033 (32); in reality it has a close relationship with Matritensis 4678 (Z, 15); see infra, p. 93. Only one paragraph of the treatise was copied in this manuscript.

10
Jan reported L(12) to be the only manuscript with the correct reading at 28.4, but L reads διαστηματικοῦ, not διαστολικοῦ.

[11] At 1.5, 23 has appealed to M for assistance (whence ἐχόντων), but this is the only reading for which 23 has appealed to M.

[12] The "S" avoids confusion with the sigla U or UP for Upsala. Occasionally S's readings are found in the apparatus even though they are obviously inferior; I do this since S was the prototype for many of the errors made by Pena and Meibom.

[13] Da Rios (lxxxif.) thinks U to be derived from M and V.

[14] See Winnington-Ingram xx-xxii, who hypothesizes that Bryennius himself wrote these interpolations.

[15] 33's contamination from U would be much less frequent than 18's.

[16] This second attribution is also found in M, but the other variants described above are not.

[17] For which see L. G. Westerink, Nicetas Magistros: Lettres d'un Exilé (Paris 1973) 9-11.

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SIGLA:

M	Venetus Marcianus app. cl. gr. VI/3 (47) saec. XII
M^1	significat lectio manus alterae (aut manuum alterarum) saec. XII-XV?
M^{ac}	significat lectio ante correctionem
C	Vaticanus gr. 2338 (f. 1^v- 3^v) (35) saec. XII-XIII
C^1	significat lectio manus alterae
C^2	significat lectiones non in parente; vide p. 68.
P	Vaticanus gr. 2338 (f. 9^v-12^r) (36) saec. XII-XIII
P^1	significat lectio manus alterae
U	Venetus Marcianus gr. 322 (46) saec. XV
U^1	significat lectio manus alterae
U^{ac}	significat lectio ante correctionem
V	Vaticanus gr. 191 (f. 291^v- 295^r) (28) saec. XIII aut XIV
Q	Vaticanus gr. 1341 (33) saec. XIV-XV
L	Lipsiensis gr. 25 (12) saec. XV aut XVI
S	Upsaliensis gr. 52 (27) saec. XVI
Z	Matritensis gr. 4678 (16) saec. XIV
N	Neapolitanus gr. 260 (f. 16^r- 21^r) (18) saec. XV
codd.	codicum MCP (UVQLSZN) consensus
cett.	eorundem praeter eos nominatos consensus
A.Q.	Aristides Quintilianus, Περὶ μουσικῆς (ed. Winnington-Ingram (Leipzig 1963))
Bry,	Manuel Bryennius, Ἁρμονικά (ed. Jonker (Groningen 1970))

1.1 Κλεονείδου

1.2 Εἰσαγωγὴ ἁρμονική

1.3 Ἁρμονική ἐστιν ἐπιστήμη θεωρητική τε καὶ πρακτικὴ

1.4 τῆς τοῦ ἠρμοσμένου φύσεως. ἠρμοσμένον δὲ τὸ

1.5 ἐκ φθόγγων τε καὶ διαστημάτων ποιὰν τάξιν ἐχόντων

1.6 συγκείμενον. μέρη δὲ αὐτῆς ἐστιν ἑπτά· περὶ φθόγγων,

1.7 περὶ διαστημάτων, περὶ γενῶν, περὶ συστημάτων, περὶ

1.8 τόνων, περὶ μεταβολῆς, περὶ μελοποιίας.

1.9 φθόγγος μὲν οὖν ἐστι φωνῆς πτῶσις ἐμμελὴς ἐπὶ

1.10 μίαν τάσιν.

1.11 διάστημα δὲ τὸ περιεχόμενον ὑπὸ δύο φθόγγων

1.12 ἀνομοίων ὀξύτητι καὶ βαρύτητι.

1.1 Κλεονείδου C^1 Εὐκλείδου M^1 Ζοσίμου Z ἐκ τῶν τοῦ Πάππου P ἀνωνύμου N om. M

1.2 Εἰσαγωγὴ ἁρμονική M^1C^1 Εἰσαγωγὴ ἁρμονικῆς πραγματείας Vat. Reg. 169 Περὶ ἁρμονικίας Z om. MCP

1.3 ἁρμονική--ἑπτά (1.6) om. P τε om. U; item 1.5

1.4 δέ ἐστι τὸ U

1.5 τάξιν ἐχόντων συγκείμενον MC τάξιν τῶν συγκειμένων ἔχον U

1.6 ἐστιν] εἰσιν U

1.7 post διαστημάτων transp. περὶ συστημάτων Q post γενῶν transp. περὶ μελοποιίας MC συστημάτων P συστήματος MC 1.8 τόνων P τόνου MC μεταβολῶν P 1.9 ante φθόγγος add. titulum περὶ φθόγγων καὶ τῶν λοιπῶν N περὶ φθόγγου καὶ τῶν λοιπῶν Q

γένος δέ ἐστι ποιὰ τεσσάρων φθόγγων διαίρεσις.

σύστημα δέ ἐστι τὸ ἐκ πλειόνων ἢ ἑνὸς διαστημάτων (2.3) συγκεί-
μενων. τόνος δέ ἐστι τόπος τὰς τῆς φωνῆς δεκτικὸς συστήματος
ἁπλατής.

μεταβολὴ δέ ἐστιν ὁμοίου τινὸς εἰς ἀνόμοιον τόπον μετάθεσις.

μελοποιία δέ ἐστι χρῆσις τῶν ὑποκειμένων τῇ
ἁρμονικῇ πραγματείᾳ πρὸς τὸ οἰκεῖον ἑκάστης ὑποθέσεως.

Ταῦτα δὲ θεωρεῖται ἐν φωνῆς ποιότητι, ἧς
κινήσεις εἰσὶ δύο, ἡ μὲν συνεχής τε καὶ λογικὴ καλουμένη,
ἡ δὲ διαστηματικὴ τε καὶ μελῳδική. ἡ μὲν
οὖν συνεχὴς κίνησις τῆς φωνῆς τάς τε ἐπιτάσεις καὶ
τὰς ἀνέσεις ἀφανῶς ποιεῖται μηδαμοῦ ἱσταμένη ἢ μέχρι
σιωπῆς. ἡ δὲ διαστηματικὴ κίνησις τῆς φωνῆς ἐναντίως
κινεῖται τῇ συνεχεῖ· μονάς τε γὰρ ποιεῖ καὶ τὰς
μεταξὺ τούτων διαστάσεις, ἑναλλὰξ αὐτῶν ἑκάτερον
τιθεῖσα. Τὰς μὲν οὖν μονὰς τάσεις καλοῦμεν, τὰς δὲ
μεταβάσεις τὰς ἀπὸ τάσεων ἐπὶ τάσεις διαστήματα. τὰ

2.2 σύστημα—συγκείμενον (2.3) transp. ad 2.1 (ante γένος) C^2

2.6 τόπον] τύπον? quaerit Jan

2.15 ἀφανῶς] ἀφανεῖς Q

2.19 τιθεῖσα] τιθεῖται U τέθειται S post τὰς δὲ add. διαστάσεις U

2.20 τάσεις. διαστήματα δὲ τὰ ποιοῦντα U fort. διαστάσεις δὲ τὰς μεταβάσεις τὰς ἀπὸ τάσεων ἐπὶ τάσεις. τὰ δὲ ποιοῦντα κ.τ.λ. διαστήματα om. Meibom

3.1 δὲ ποιοῦντα τὴν τῶν τάσεων διαφορὰν ἐπίτασίς ἐστι

3.2 καὶ ἄνεσις, ἀποτέλεσμα δὲ τούτων ὀξύτης καὶ βαρύτης.

3.3 τὸ μὲν γὰρ δι' ἐπιτάσεως γινόμενον εἰς ὀξύτητα ἄγει,

3.4 τὸ δὲ δι' ἀνέσεως εἰς βαρύτητα. ὀξύτης μὲν οὖν

3.5 ἐστι τὸ δι' ἐπιτάσεως γινόμενον ἀποτέλεσμα, βαρύτης δὲ

3.6 τὸ δι' ἀνέσεως. ἀμφοῖν γὰρ συμβέβηκε τὸ τετάσθαι.

3.7 καλοῦνται δὲ τάσεις καὶ φθόγγοι· τάσεις

3.8 μὲν ἀπὸ τῶν καθαπτῶν ὀργάνων παρὰ τὸ τετάσθαι,

3.9 φθόγγοι δὲ, ἐπεὶ ὑπὸ φωνῆς ἐνεργοῦνται.

3.10 φθόγγοι δέ εἰσι τῇ μὲν τάσει ἄπειροι, τῇ δὲ δυνάμει

3.11 καθ' ἕκαστον γένος δεκαοκτώ.

3.1 post ἐπίτασίς hab. δέ $U^{ac}Z$

3.2 ante ἀποτέλεσμα add. τὸ U ἀποτελέσματα P ὀξύτης καὶ βαρύτης MCP ὀξύτης βαρύτης U^{1} ὀξύτητι βαρύτητι (inscr. τος) L ὀξύτητος βαρύτητος Esc. X-I-12

3.4 ante ὀξύτης add. βαρύτης μέν ἐστι τὸ δι' ἀνέσεως γινόμενον ἀποτέλεσμα C^{2} ὀξύτης μὲν οὖν ἐστι τὸ Q καὶ ὀξύτης μὲν οὖν ἐστι τὸ M^{1} ὀξύτης δὲ τὸ MCP ὀξύτης Bonon. 2432

3.5 βαρύτης δὲ τὸ δι' ἀνέσεως om. $M^{ac}C$

3.6 post τὸ (prius) add. ἐναντίως ὅτι τάσις καλεῖται παρὰ τὸ τετᾶσθαι. καλεῖται δὲ καὶ φθόγγος, ἐπεὶ ὑπὸ φωνῆς ἐνεργεῖται Z ἀμφοῖν—τετᾶσθαι (3.7) del. Jan

3.7 ante τάσεις add. αἱ Z

3.8 καθαπτῶν MC καθ' αὐτῶν U καθ' αὐτῶν LS

3.12 Γένη δέ ἐστι τρία, διάτονον χρῶμα ἁρμονία.

3.13 καὶ μελῳδεῖται τὸ μὲν διάτονον ἐπὶ μὲν τὸ βαρὺ κατὰ

3.14 τόνον καὶ τόνον καὶ ἡμιτόνιον, ἐπὶ δὲ τὸ ὀξὺ ἐναντίως

3.15 κατὰ ἡμιτόνιον καὶ τόνον καὶ τόνον. τὸ δὲ

3.16 χρῶμα ἐπὶ μὲν τὸ βαρὺ κατὰ τριημιτόνιον καὶ ἡμιτόνιον

3.17 καὶ ἡμιτόνιον, ἐπὶ δὲ τὸ ὀξὺ ἐναντίως κατὰ

3.18 ἡμιτόνιον καὶ ἡμιτόνιον καὶ τριημιτόνιον. ἡ δὲ ἁρμονία

4.1 ἐπὶ μὲν τὸ βαρὺ κατὰ δίτονον καὶ δίεσιν καὶ δίεσιν,

4.2 ἐπὶ δὲ τὸ ὀξὺ ἐναντίως κατὰ δίεσιν καὶ δίεσιν καὶ δίτονον.

4.4 Εἰσὶν οὖν οἱ μὲν ἐν τῷ διατόνῳ φθόγγοι οἵδε·

4.5 προσλαμβανόμενος,

4.6-8 ὑπάτη ὑπάτων, παρυπάτη ὑπάτων, λιχανὸς ὑπάτων διάτονος,

4.9-11 ὑπάτη μέσων, παρυπάτη μέσων, λιχανὸς μέσων διάτονος,

4.12 μέση,

4.13-15 τρίτη συνημμένων, παρανήτη συνημμένων διάτονος, νήτη συνημμένων,

4.16 παραμέση,

4.17-18 τρίτη διεζευγμένων, παρανήτη διεζευγμένων διάτονος,

4.19 νήτη διεζευγμένων,

3.13-14 κατὰ τὸν τόνον P

4.4 εἰσὶν οὖν οἱ Q εἰσὶ δὲ P εἰσὶν οἱ MC post διατόνῳ add. γένει C

4.11 διάτονος transp. ad 4.12 (ante μέση)

4.13 τρίτη] νήτη P

4.14 διάτονος transp. ad 4.15 C

4.16 παραμέση συνημμένων U

4.20-21 τρίτη ὑπερβολαίων, παρανήτη ὑπερβολαίων διάτονος,

4.22 νήτη ὑπερβολαίων.

5.1 Ἐν δὲ χρώματι οἵδε·

5.2 προσλαμβανόμενος,

5.3-5 ὑπάτη ὑπάτων, παρυπάτη ὑπάτων, λιχανὸς ὑπάτων χρωματική,

5.6-8 ὑπάτη μέσων, παρυπάτη μέσων, λιχανὸς μέσων χρωματική,

5.9 μέση,

5.10-11 τρίτη συνημμένων, παρανήτη συνημμένων χρωματική,

5.12 νήτη συνημμένων,

5.13 παραμέση,

5.14-15 τρίτη διεζευγμένων, παρανήτη διεζευγμένων χρωματική,

5.16 νήτη διεζευγμένων,

5.17-18 τρίτη ὑπερβολαίων, παρανήτη ὑπερβολαίων χρωματική,

5.19 νήτη ὑπερβολαίων.

5.20 Ἐν δὲ ἁρμονίᾳ οἵδε·

5.21 προσλαμβανόμενος,

5.22-24 ὑπάτη ὑπάτων, παρυπάτη ὑπάτων, λιχανὸς ὑπάτων ἐναρμόνιος,

5.25-27 ὑπάτη μέσων, παρυπάτη μέσων, λιχανὸς μέσων ἐναρμόνιος,

5.28 μέση,

6.1-2 τρίτη συνημμένων, παρανήτη συνημμένων ἐναρμόνιος,

6.3 νήτη συνημμένων,

6.4 παραμέση,

5.15 διεζευγμένων] συνημμένων Q

5.25-27 μέση U

6.1 post συνημμένων add. ἐναρμόνιος $M^{ac}C$; item 6.5, 6.8

6.2 ante παρανήτη add. λιχανὸς συνημμένων, ἐναρμόνιος U

6.4 παρανήτη συνημμένων· παραμέση συνημμένων ἐναρμόνιος U

6.5-6 τρίτη διεζευγμένων, παρανήτη διεζευγμένων ἐναρμόνιος,

6.7 νήτη διεζευγμένων,

6.8-9 τρίτη ὑπερβολαίων, παρανήτη ὑπερβολαίων ἐναρμόνιος,

6.10 νήτη ὑπερβολαίων.

6.11 Κατὰ δὲ μίξιν τῶν γενῶν οἵδε·

6.12 προσλαμβανόμενος,

6.13-14 ὑπάτη ὑπάτων, παρυπάτη ὑπάτων,

6.15 λιχανὸς ὑπάτων ἐναρμόνιος,

6.16 λιχανὸς ὑπάτων χρωματική,

6.17 λιχανὸς ὑπάτων διάτονος,

6.18-19 ὑπάτη μέσων, παρυπάτη μέσων,

6.20 λιχανὸς μέσων ἐναρμόνιος,

6.21 λιχανὸς μέσων χρωματική,

6.22 λιχανὸς μέσων διάτονος,

6.23 μέση,

6.24 τρίτη συνημμένων,

7.1 παρανήτη συνημμένων ἐναρμόνιος,

7.2 παρανήτη συνημμένων χρωματική,

7.3 παρανήτη συνημμένων διάτονος,

6.5 ut 6.1 MC ἐναρμόνιος νήτη διεζευγμένων U

6.6-7 ἐναρμόνιος παρανήτη διεζευγμένων, παραμέση διεζευγμένων ἐναρμόνιος U

6.9-10 ἐναρμόνιος, νήτη ὑπερβολαίων om. P

6.15-18 ἐναρμόνιος λιχανὸς, ὑπάτων διάτονος, ὑπάτη μέσων, χρωματική λιχανὸς ὑπάτων CP

7.4 νήτη συνημμένων,

7.5 παραμέση,

7.6 τρίτη διεζευγμένων,

7.7 παρανήτη διεζευγμένων έναρμόνιος,

7.8 παρανήτη διεζευγμένων χρωματική,

7.9 παρανήτη διεζευγμένων διάτονος,

7.10 νήτη διεζευγμένων,

7.11 τρίτη ὑπερβολαίων,

7.12 παρανήτη ὑπερβολαίων έναρμόνιος,

7.13 παρανήτη ὑπερβολαίων χρωματική,

7.14 παρανήτη ὑπερβολαίων διάτονος,

7.15 νήτη ὑπερβολαίων.

7.16 Τῶν δὲ ἐξηρτημένων φθόγγων οἱ μέν εἰσιν

7.17 ἑστῶτες, οἱ δὲ κινούμενοι. ἑστῶτες μὲν οὖν εἰσιν

7.18 ὅσοι ἐν ταῖς τῶν γενῶν διαφοραῖς οὐ μεταπίπτουσιν,

7.19 ἀλλὰ μένουσιν ἐπὶ μιᾶς τάσεως. κινούμενοι δὲ ὅσοι

7.20 τοὐναντίον πεπόνθασιν· ἐν γὰρ ταῖς τῶν γενῶν διαφοραῖς

7.21 μεταβάλλουσι καὶ οὐ μένουσιν ἐπὶ μιᾶς τάσεως.

7.6 τρίτη] νήτη $M^{1}P$

7.15 post ὑπερβολαίων add. A.Q. 8.3—9.12(ἵσταται) Q

7.17 add. scholium: οἵτε ἄπυκνοι καὶ οἱ βαρύπυκνοι N

7.22 εἰσὶν οὖν οἱ ἑστῶτες ὀκτὼ οἵδε· προσλαμβανόμενος,

7.23 ὑπάτη ὑπάτων, ὑπάτη μέσων, μέση, νήτη συνημμένων,

7.24 παραμέση, νήτη διεζευγμένων, νήτη ὑπερβολαίων.

7.25 κινούμενοι δὲ οἱ ἀνὰ μέσον τούτων πάντες.

8.1 Τῶν δὲ ἑστώτων οἱ μέν εἰσι βαρύπυκνοι, οἱ δὲ

8.2 ἄπυκνοι καὶ περιέχοντες τὰ τέλεια συστήματα.

8.3 βαρύπυκνοι μὲν οὖν εἰσι πέντε οἵδε· ὑπάτη ὑπάτων, ὑπάτη

8.4 μέσων, μέση, παραμέση, νήτη διεζευγμένων.

8.5 ἄπυκνοι δὲ καὶ περιέχοντες τὰ τέλεια συστήματα οἱ

8.6 λοιποὶ τρεῖς οἵδε· προσλαμβανόμενος, νήτη συνημμένων,

8.7 νήτη ὑπερβολαίων.

8.8 Τῶν δὲ κινουμένων οἱ μέν εἰσι μεσόπυκνοι, οἱ

8.9 δὲ ὀξύπυκνοι, οἱ δὲ διάτονοι. μεσόπυκνοι μὲν οὖν

8.10 εἰσι πέντε οἵδε· παρυπάτη ὑπάτων, παρυπάτη μέσων,

8.11 τρίτη συνημμένων, τρίτη διεζευγμένων, τρίτη ὑπερβολαίων.

8.12 ὀξύπυκνοι δὲ ὁμοίως κατὰ γένος πέντε· ἓν μὲν

7.25 κινούμενοι δὲ οἱ ἀνὰ MCP κινούμενοι δὲ, οἵδε, οἱ ἀνὰ U μέσον M μέσων CP

8.1 add. scholium: βρ[υέννιος] A[ristides] Q[uintilianus] ὑπατοειδεῖς N

8.4 add. scholium: (post μέση): ἤτοι ἐν τῷ συνεμμένων συστήματι· ἐν δὲ τῷ τελείῳ αὖ N

8.9 ante μεσόπυκνοι add. εἶτ' οὖν ἄπυκνοι Q

8.10 παρυπάτη ὑπάτων] ὑπάτη ὑπάτων M^{ac}CP 8.11 τρίτη (ultima)] τῶν M^{ac}C

8.12 add. scholium: ἔστασε γὰρ παρὰ τοῖς παλαιοῖς καὶ τὸ τῶν συνημμένων σύστημα δόξαν τοῦ τελείου. διὰ τοῦτο καὶ ἡ νήτη τῶν συνημμένων ἐλέγετο, περιέχουσα τὸ τέλειον σύστημα βαρύπυκνοι, οἱ τὰς πρώτας χώρας τοῦ πυκνοῦ κατέχοντες. μεσόπυκνοι, οἱ τὰς μέσας. ὀξύπυκνοι, οἱ τὰς ἐσχάτας. ἄπυκνοι, οἱ τῆς κατὰ τὸ πυκνὸν τετραχόρδου διαθέσεως κατὰ μηδένα κανωνοῦτες τόπον. N; cf. A.Q. 9.16f.

8 13 ἁρμονίᾳ οἱ ἐναρμόνιοι, ἐν δὲ χρώματι οἱ χρωματικοί·
8.14 τὸ γὰρ διάτονον οὐ μετέχει πυκνοῦ. εἰσὶν οὖν οἱ μὲν
8.15 ἐν τῇ ἁρμονίᾳ οἵδε· λιχανὸς ὑπάτων ἐναρμόνιος,
8.16 λιχανὸς μέσων ἐναρμόνιος, παρανήτη συνημμένων ἐναρμόνιος,
8.17 παρανήτη διεζευγμένων ἐναρμόνιος, παρανήτη
8.18 ὑπερβολαίων ἐναρμόνιος. ἐν δὲ τῷ χρώματι οἵδε·
8.19 λιχανὸς ὑπάτων χρωματική, λιχανὸς μέσων χρωματική,
8.20 παρανήτη συνημμένων χρωματική, παρανήτη διεζευγμένων
8.21 χρωματική, παρανήτη ὑπερβολαίων χρωματική.
8.22 ἐν δὲ τῷ διατόνῳ οἵδε· λιχανὸς ὑπάτων διάτονος, λιχανὸς
8.23 μέσων διάτονος, παρανήτη συνημμένων διάτονος, παρανήτη
9.1-2 διεζευγμένων διάτονος, παρανήτη ὑπερβολαίων διάτονος.
9.3 Τῶν δὲ διαστημάτων διαφοραί εἰσι πέντε, ᾗ
9.4 τε μεγέθει ἀλλήλων διαφέρει καὶ ᾗ κατὰ γένος καὶ ᾗ
9.5 τὰ σύμφωνα τῶν διαφώνων καὶ τὰ σύνθετα τῶν
9.6 ἀσυνθέτων καὶ τὰ ῥητὰ τῶν ἀλόγων. ἡ μὲν οὖν

8.19 χρωματική(alterum) perfossum M^1

8.20 παρανήτη συν. χρ. om. M^{ac}

8.21 χρωματική (bis) perfossum M^1

8.22 ante ἐν add. A.Q. 9.15--10.15(λιχανοειδέσιν) Q ἐν δὲ--διάτονος (9.2) hab. CPS, sed χρωματική (alterum 8.19)—διάτονος (alterum 8.23) om.; add. C^1P^1 ἐν δὲ τῷ διατόνῳ C^1P^1 οἱ δὲ διάτονοι Jan

9.3 ᾗ] ἥ Z; item 9.4(bis)

9.4 καὶ ᾗ(prius)] ἥτε S

9.5 post καὶ add. ᾗ Jan; item 9.6 add. ἥ Z; item 9.6 σύνθετα] ἀσύνθετα P

9.7 κατὰ μέγεθός ἐστι, καθ' ἣν ἃ μέν ἐστι μείζονα τῶν
9.8 διαστημάτων, ἃ δὲ ἐλάττονα, οἷον δίτονον, τόνος,
9.9 ἡμιτόνιον, διὰ τεσσάρων, διὰ πέντε, διὰ πασῶν καὶ
9.10 τὰ ὅμοια. ἡ δὲ κατὰ γένος, καθ' ἣν ἃ μέν ἐστι
9.11 τῶν διαστημάτων διατονικὰ, ἃ δὲ χρωματικὰ, ἃ δὲ
9.12 ἐναρμόνια. ἡ δὲ τοῦ συμφώνου, καθ' ἣν ἃ μέν
9.13 ἐστι τῶν διαστημάτων σύμφωνα, ἃ δὲ διάφωνα. σύμφωνα
9.14 μὲν οὖν ἐστι διὰ τεσσάρων, διὰ πέντε, δια πασῶν
9.15 καὶ τὰ ὅμοια. διάφωνα δὲ τὰ ἐλάττονα τοῦ διὰ
9.16 τεσσάρων πάντα καὶ τὰ μεταξὺ τῶν συμφώνων πάντα.
9.17 ἐλάττω μὲν οὖν ἐστι τοῦ διὰ τεσσάρων δίεσις, ἡμιτόνιον,
9.18 τόνος, δίτονον, μεταξὺ δὲ τῶν συμφώνων τρίτονον,
9.19 τετράτονον, πεντάτονον καὶ τὰ ὅμοια. ἔστι δὲ
9.20 συμφωνία μὲν κρᾶσις δύο φθόγγων ὀξυτέρου καὶ
10.1 βαρυτέρου· διαφωνία δὲ τούναντίον δύο φθόγγων ἀμιξία
10.2 μὴ οἷων τε κραθῆναι, ἀλλὰ τραχυνθῆναι τὴν ἀκοήν.

9.14 ἐστι τὰ διὰ Z 9.16 πάντα (prius) om. Meibom πάντα (alterum) M^1 πέντε MP πέντε πάντα Esc. X-I-12

9.17 ἐλάττω P^1 ἐλάττων MC ἐλάττονα QZ add. scholium: ὅρα τὰ διὰ τεσσάρων καὶ διὰ πέντε καὶ διὰ πασῶν συστήματα ἐκ πόσων συνίστανται C^1

9.18 post τόνος add. τριημιτόνιον M^1 δίτονον] διάτονον M^{ac}

9.20 δύο] δυοῖν Q

9.20-10.1 ὀξυτέρου καὶ βαρυτέρου] ὀξύτητι καὶ βαρύτητι et add. Bry. 100.14--1-0.21 Q

10.1 διαφωνία—ἀμιξία hab. S om. cett. διαφωνία--ἀκοήν (10.2) om. Q

10.2 μὴ οἷων τε κραθῆναι S μὴ ὥστε ἢ καθαρθῆναι MCP μὴ ὥστε ἐκκαθαρθῆναι Z ὥστε μὴ κραθῆναι Pena τραχῦναι P τραχυνθῆναι cett.

10.3 ἡ δὲ τοῦ συνθέτου ἐστὶ διαφορά, καθ' ἣν ἃ μέν
10.4 ἐστι τῶν διαστημάτων ἀσύνθετα, ἃ δὲ σύνθετα. ἀσύνθετα
10.5 μὲν οὖν διαστήματά ἐστι τὰ ὑπὸ τῶν ἐξῆς φθόγγων
10.6 περιεχόμενα, οἷον ὑπάτης καὶ παρυπάτης, καὶ λιχανοῦ
10.7 καὶ μέσης· ὁ αὐτὸς λόγος καὶ ἐπὶ τῶν λοιπῶν
10.8 διαστημάτων. σύνθετα δὲ τὰ ὑπὸ τῶν μὴ ἐξῆς, οἷον
10.9 μέσης καὶ παρυπάτης, μέσης καὶ νήτης, παραμέσης καὶ
10.10 ὑπάτης. ἔστι δὲ τινα κοινὰ συνθέτου καὶ ἀσυνθέτου
10.11 διαστήματα, τὰ ἀπο ἡμιτονίου μέχρι διτόνου. τὸ μὲν
10.12 γὰρ ἡμιτόνιόν ἐστιν ἐν ἁρμονίᾳ σύνθετον, ἐν δὲ χρώματι
10.13 καὶ διατόνῳ ἀσύνθετον· ὁ τόνος ἐν μὲν χρώματι
10.14 σύνθετος, ἐν δὲ διατόνῳ ἀσύνθετος· τὸ τριημιτόνιον
10.15 ἐν μὲν χρώματι ἀσύνθετον, ἐν δὲ διατόνῳ σύνθετον·
10.16 τὸ δίτονον ἐν μὲν ἁρμονίᾳ ἀσύνθετον, ἐν δὲ χρώματι
10.17 καὶ διατόνῳ σύνθετον. τὰ δὲ ἐλάττω τοῦ ἡμιτονίου
11.1 πάντα ἐστὶν ἀσύνθετα· ὁμοίως δὲ καὶ τὰ μείζω τοῦ
11.2 διτόνου πάντα σύνθετα. ἡ δὲ τοῦ ῥητοῦ καὶ ἀλόγου
11.3 διαφορά ἐστι, καθ' ἣν τῶν διαστημάτων ἃ μέν
11.4 ἐστι ῥητὰ, ἃ δ' ἄλογα. ῥητὰ μὲν οὖν ἐστιν, ὧν οἱόν
11.5 τέ ἐστι τὰ μεγέθη ἀποδιδόναι, οἷον τόνον, ἡμιτόνιον,

10.6 καὶ (prius) om. $M^{ac}C$

10.7 ante μέσης add. ὑπάτης U ὑπάτης μέσων Meibom

10.12 ante ἁρμονίᾳ add. μεν Z

10.13 post ὁ add. δὲ P

10.16 δίτονον] διάτονον M^{ac}

10.17 διατόνῳ] διτόνῳ P ἐλάττω] ἐλάττονα Q

11.2 διτόνου] διατόνου P

11.6 δίτονον, τρίτονον καὶ τὰ ὅμοια· ἄλογα δὲ τὰ παραλλάττοντα
11.7 ταῦτα τὰ μεγέθη ἐπὶ τὸ μεῖζον ἢ ἐπὶ τὸ ἔλαττον
11.8 ἀλόγῳ τινὶ μεγέθει.
11.9 Γένη δέ ἐστι τρία τὰ προειρημένα. πᾶν οὖν
11.10 ἔσται μέλος ἤτοι διατονικὸν ἢ χρωματικὸν ἢ ἐναρμόνιον
11.11 ἢ κοινὸν ἢ μικτὸν ἐκ τούτων. διατονικὸν μὲν
11.12 οὖν ἐστι τὸ τῇ διατονικῇ διαιρέσει χρώμενον, χρωματικὸν
11.13 δὲ τὸ τῇ χρωματικῇ, ἐναρμόνιον δὲ τὸ τῇ ἐναρμονίῳ.
11.14 κοινὸν δὲ τὸ ἐκ τῶν ἑστώτων συγκείμενον.
11.15 μικτὸν δὲ τὸ ἐν ᾧ δύο ἢ χαρακτῆρες γενικοὶ
11.16 ἐμφαίνονται, οἷον διατόνου καὶ χρώματος ἢ διατόνου
11.17 καὶ ἁρμονίας ἢ χρώματος καὶ ἁρμονίας ἢ καὶ διατόνου
11.18 καὶ χρώματος καὶ ἁρμονίας. γίνονται δὲ αἱ τῶν γενῶν
11.19 διαφοραὶ παρὰ τοὺς κινουμένους τῶν φθόγγων·
11.20 κινεῖται δὲ ἡ μὲν λιχανὸς ἐν τονιαίῳ τόπῳ, ἡ δὲ
11.21 παρυπάτη ἐν διεσιαίῳ. λιχανὸς μὲν οὖν ἐστιν ὀξυτάτη
12.1 ἡ τόνον ἀπὸ τοῦ ὀξυτέρου ἀπέχουσα τῶν τὸ τετράχορδον

11.6 post ὅμοια add. Bry. 102.19-20 Q

11.9 post προειρήμενα add. titulum Περὶ μέλους Z 11.14 post ἑστώτων add. φθόγγων P

11.16 ἢ διατόνου—χρώματος (11.18) om. C

11.19 post φθόγγων add. τόπους U

11.21 διεσιαίῳ M^1P δεσιαίω C δισιαίῳ C^1 δεσίω M διαισιαίῳ S

12.1 ὀξυτέρου M ἐτέρου V ἐτέρου τόνου U^1Z

περιεχόντων, βαρυτάτη δὲ ἡ δίτονον. ὁμοίως δὲ καὶ
παρυπάτη ἐστὶ βαρυτάτη μὲν ἡ δίεσιν ἀπὸ τοῦ βαρυτέρου
τῶν τὸ τετράχορδον περιεχόντων ἀπέχουσα,
ὀξυτάτη δὲ ἡ ἡμιτόνιον ἀπέχουσα.

Χρόα δέ ἐστι γένους εἰδικὴ διαίρεσις. χρόαι
δέ εἰσιν αἱ ῥηταὶ καὶ γνώριμοι ἔξ, ἁρμονίας μία,
χρώματος τρεῖς, διατόνου δύο.
ἡ μὲν οὖν τῆς ἁρμονίας τῇ αὐτῇ τοῦ γένους
διαιρέσει κέχρηται· μελῳδεῖται γὰρ κατὰ δίεσιν καὶ
δίεσιν τὴν ἴσην καὶ δίτονον.
τῶν δὲ χρωματικῶν διαιρέσεων βαρυτάτη μέν ἐστιν
ἡ τοῦ μελανοῦ χρώματος χρόα, μελῳδεῖται δὲ κατὰ
δίεσιν τριτημόριον τόνου καὶ δίεσιν τὴν ἴσην καὶ τὸ
ἴσον τόνῳ καὶ τῷ ἡμίσει καὶ τρίτῳ. τὸ δὲ ἡμιόλιον

12.3 μὲν] μέση U 12.4 τὸ om. M 12.6 χρόαι] χροίαι $M^{ac}C$

12.9 αὐτῇ] αὐτοῦ P

12.10 post διαιρέσει add. τῇ αὐτῇ MCP add. καὶ αὐτῇ QZ add. καὶ αὐτὴ Meibom (ut Bry.) hab. solum διαιρέσει P^1 post δίεσιν add. τεταρτημόριον P^1 add. τετ. τόνου Q add. το τετ. τόνου S 12.10-11 καὶ δίεσιν om. $M^{ac}C$

12.11 δίτονον] διάτονον M^{ac} post δίτονον add. ἀσύνθετον S add. A.Q. 12.6-8 Q

12.12-13 βαρυτάτη--χρόα] τὸ μὲν καλεῖται μελανὸν χρῶμα. τὸ δὲ ἡμιόλιον, τὸ δὲ τονιαῖον, τὸ μὲν οὖν μελανὸν χρῶμα S hoc add. ante βαρυτάτη N

12.14 ante δίεσιν (prius) add. τὴν MCP ante τριτημόριον add. τὸ U add. καὶ S τόνου om. C

12.15 τῷ ἡμίσει] ἡμίσει τόνου Q καὶ (alterum) om. $M^{ac}CP$ post τρίτῳ add. καὶ δίεσιν τὴν ἡμίσειαν ἡμιτονίου τόνου τριημιτόνιον καὶ τὸ διὰ πέντε καὶ τὴν ἴσην τόνῳ καὶ τὴν τετάρτην U^1 hoc hab. post τόνου (12.14) Z add. ἀσύνθετον διάστημα M^1 hoc add. ante ἴσον (12.15) QZ

13.1 κατὰ δίεσιν ἡμιόλιον τῆς ἐναρμονίου διέσεως καὶ
13.2 δίεσιν τὴν ἴσην καὶ ἑπτα διέσεων τεταρτημορίων
13.3 ἀσύνθετον διάστημα. τὸ δὲ τονιαῖον χρῶμα τῇ αὐτῇ
13.4 τοῦ γένους χρόᾳ κέχρηται· μελῳδεῖται γὰρ κατὰ ἡμι-
13.5 τόνιον καὶ ἡμιτόνιον καὶ τριημιτόνιον. κέκληται δὲ
13.6 τὰ εἰρημένα χρώματα ἀπὸ τῶν ἐνυπαρχόντων αὐτοις
13.7 πυκνῶν· τό τε γὰρ τονιαῖον ἀπὸ τοῦ ἐνυπάρχοντος
13.8 αὐτῷ κατὰ συνθέσεως τόνου, καὶ ἡμιόλιον ἀπὸ τῶν
14.1 ἐνυπαρχουσῶν αὐτῷ διέσεων ἡμιολίων τῶν ἐναρμονίων
14.2 διέσεων· μαλακὸν δὲ τὸ τοῦ ἐλαχίστου πυκνοῦ
14.3 ὡσαύτως χρῶμα, ἐπειδὴ τὸ ἐν αὐτῷ πυκνὸν ἀνίεται
14.4 τε καὶ ἐκλύεται.
14.5 τῶν δὲ διατονικῶν διαιρέσεων τὸ μὲν διάτονον
14.6 μαλακὸν καλεῖται, τὸ δὲ σύντονον. ἡ μὲν οὖν τοῦ

13.1 κατὰ δίεσιν—διέσεως om. $M^{ac}U^{1}$ et pergit καὶ δίεσιν ἑπτὰ μὲν ἡμιτόνιον σύνθετόν ἐστιν διάστημα τρὶς γὰρ ἑπτὰ· καὶ εἴκοσι καὶ ἕν U^{1} ἡμιόλιον—δίεσιν (13.2) om. C

13.2 καὶ om. $M^{ac}C$ διέσεων τετ. $M^{1}U$ (τετραμορίων U) τετ. διέσεων invert. CP^{1} τεταρτημορίων om. M

13.3 ante διάστημα add. τὸ $M^{ac}C$ post διάστημα pergit ἑπτὰ διέσεων ὁ τρίτῳ ὁ τεταρτημορίῳ· τρὶς καὶ (γὰρ P) ἑπτὰ· εἴκοσι καὶ ἕν $M^{ac}P$; cf. 13.1 add. solum τρὶς γὰρ ἑπτὰ· κ καὶ α C(ut vid.)

13.5 κέκληνται U

13.8 αὐτῷ—δὲ τὸ (14.2) M^{1} κατὰ σύνθεσιν τόνου καὶ ἡμιόλιον ἀπὸ C^{1} καὶ ἡμιόλιον ἀπὸ P^{1} ἡμιόλιόν ἐστι P ἡμιόλιον—δὲ τὸ (14.2) om. M^{ac}

14.1 ἐνυπαρχόντων U

14.3 post ὡσαύτως add. καὶ U post πυκνὸν add. χρῶμα codd., om. Jan

14.4 ἐκλύεται $M^{1}P$ ἑκ M ἑκ κλύεται C διατήκεται Z

14.5 τῶν δὲ om. M^{ac}

μαλακοῦ διατόνου χρόα μελῳδεῖται κατὰ ἡμιτόνιον καὶ
τριῶν διέσεων ἀσύνθετον διάστημα καὶ πέντε διέσεων
ὁμοίως ἀσύνθετον διάστημα. ἡ δὲ τοῦ συντόνου διατόνου
τῇ αὐτῇ τοῦ γένους ἐπικοινωνεῖ διαιρέσει· μελῳ-
δεῖται γὰρ κατὰ ἡμιτόνιον καὶ τόνον καὶ τόνον.

Δείκνυνται δὲ καὶ δι' ἀριθμῶν αἱ χρόαι τὸν τρόπον
τοῦτον. ὑποτίθεται γὰρ ὁ τόνος εἰς δώδεκά τινα
ἐλάχιστα μορία διαιρούμενος, ὧν ἕκαστον δωδεκατημόριον
τόνου καλεῖται· ἀναλόγως δὲ τῷ τόνῳ καὶ τὰ
λοιπὰ διαστήματα, τὸ μὲν γὰρ ἡμιτόνιον εἰς ἕξ δωδε-
κατημορία, ἡ δὲ δίεσις ἡ μὲν τεταρτημόριος εἰς τρία,
ἡ δὲ τριτημόριος εἰς τέσσαρα, ὅλον δὲ τὸ διὰ τεσσάρων
εἰς τριάκοντα. ἡ μὲν οὖν ἁρμονία μελῳδηθήσεται
κατὰ τριῶν δωδεκατημορίων μέγεθος καὶ τριῶν καὶ εἴκοσι τέσσαρα
τὸ δὲ μαλακὸν χρῶμα κατὰ τεσσάρων καὶ τεσσάρων καὶ εἴκοσι δύο,
τὸ δὲ
ἡμιόλιον χρῶμα κατὰ τέσσαρα ἥμισυ καὶ τέσσαρα ἥμισυ καὶ εἴκοσι
καὶ ἕν,
τὸ δὲ τονιαῖον χρῶμα κατὰ ἕξ καὶ ἕξ καὶ δεκαοκτώ. τὸ δὲ μα-
λακὸν διάτονον κατὰ ἕξ καὶ ἐννέα καὶ δεκαπέντε, τὸ δὲ σύντονον

14.8 post τριῶν et post πέντε add. τεταρτημορίων C^1 καὶ κατὰ πέντε U

14.11 καθὼς ἡμιτόνιον M καὶ τόνον om. $M^{ac}C$

14.12 δείκνυται C δι' ἀριθμῶν P ἀριθμῶν M ἀριθμῷ QZ ἐν ἀριθμῷ C^1

14.20 εἴκοσι τεσσάρων N 14.21 εἴκοσι δυοῖν N

14.22 τέσσαρα (bis)]τεσσάρων Meibom 14.23 ὀκτωκαίδεκα Meibom

15.1 πεντέδεκα N

15.2 κατὰ ἕξ καὶ δώδεκα καὶ δώδεκα.

15.3 Τῶν δὲ συστημάτων διαφοραί εἰσιν ἑπτά.

15.4 τέσσαρες μὲν αἱ αὐταὶ τοῖς διαστήμασιν, ἥ τε κατὰ

15.5 μέγεθος καὶ ἡ κατὰ γένος καὶ ἡ τοῦ συμφώνου καὶ διαφώνου καὶ ἡ

15.6 τοῦ ῥητοῦ καὶ ἀλόγου. τρεῖς δὲ ἴδιαι τῶν συστημάτων

15.7 διαφοραί εἰσιν, ἡ τοῦ ἑξῆς καὶ ὑπερβατοῦ καὶ ἡ

15.8 τοῦ συνημμένου καὶ διεζευγμένου καὶ ἡ τοῦ ἀμεταβόλου

15.9 καὶ ἐμμεταβόλου. μεγέθει μὲν οὖν διαφέρει τὰ

15.10 μείζω συστήματα τῶν ἐλαττόνων καθάπερ τὸ διὰ πασῶν

15.11 τοῦ τριτόνου ἡ διὰ πέντε ἢ διὰ τεσσάρων ἢ τῶν

15.12 ὁμοίων. γένει δὲ τὰ διατονικὰ τῶν ἐναρμονίων ἢ

15.13 χρωματικῶν, ἢ τὰ χρωματικὰ ἢ ἐναρμόνια τῶν λοιπῶν.

15.14 τῇ δὲ τοῦ συμφώνου καὶ διαφώνου διοίσει τὰ

16.1 ὑπὸ τῶν συμφώνων φθόγγων περιεχόμενα τῶν ὑπὸ

16.2 διαφώνων. σύμφωνα δέ ἐστιν ἐν τῷ ἀμεταβόλῳ

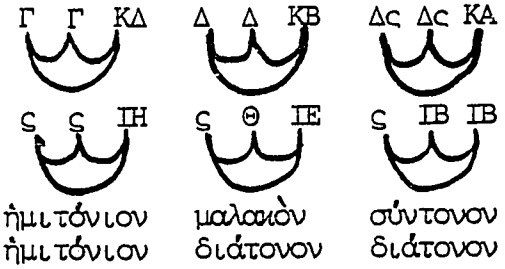
16.3 συστήματι ἕξ· ἐλάχιστον μὲν τὸ διὰ τεσσάρων, τόνων

16.4 δύο ἡμίσεος, οἷόν ἐστι τὸ ἀπὸ ὑπάτης ὑπάτων ἐπὶ

15.2 δώδεκα (alterum) ιᾱ P

hic scholium hab. Z: Γ Γ ΚΔ
Δ Δ ΚΒ
δc δc ΚΑ
ς ς ιη
ς ϑ ιε
ς ιβ ιβ

et P:



15.5 post συμφώνου hab. καὶ διαφώνου M^1 om. MCP

15.7 καὶ τοῦ ὑπερβατοῦ Meibom

15.12 γένη MC post διατονικὰ add. διαφέρει Z

15.13 post ἢ (alterum) add. τὰ Q

15.14 διοίσει—διαφώνων (16.2)] διαφορᾷ ὁμοίως διοίσει Z

16.5 ὑπάτην μέσων· δεύτερον δὲ τὸ διὰ πέντε, τόνων
16.6 τριῶν ἡμίσεος, οἷόν ἐστι τὸ ἀπὸ προσλαμβανομένου
16.7 ἐπὶ ὑπάτην μέσων· τρίτον δὲ τὸ διὰ πασῶν,
16.8 τόνων ἕξ, οἷόν ἐστι τὸ ἀπὸ προσλαμβανομένου ἐπὶ
16.9 μέσην· τέταρτον δὲ τὸ διὰ πασῶν καὶ διὰ τεσσάρων,
16.10 τόνων ὀκτὼ ἡμίσεος, οἷόν ἐστι τὸ ἀπὸ προσλαμβανομένου
16.11 ἐπὶ νήτην συνημμένων ἢ παρανήτην διεζευγμένων
16.12 διάτονον· πέμπτον τὸ διὰ πασῶν καὶ διὰ
16.13 πέντε, τόνων ἐννέα ἡμίσεος, οἷόν ἐστι τὸ ἀπὸ προσ-
16.14 λαμβανομένου ἐπὶ νήτην διεζευγμένων· ἕκτον τὸ δὶς
16.15 διὰ πασῶν, τόνων δώδεκα, οἷόν ἐστι τὸ ἀπὸ προσλαμ-
16.16 βανομένου ἐπὶ νήτην ὑπερβολαίων. τὸ δὲ συνημμένον
16.17 σύστημα πρόεισι μέχρι τετάρτου συμφώνου·
16.18 πρῶτον γὰρ ἐν αὐτῷ τὸ διὰ τεσσάρων, δεύτερον τὸ
16.19 διὰ πέντε, τρίτον τὸ διὰ πασῶν, τέταρτον τὸ διὰ

16.6 τριῶν καὶ ἡμίσεος C^{1}

16.7 ὑπάτη M

16.10 post ὀκτὼ add. καὶ MCP ἡμίσους $M^{ac}C$

16.12 post πέμπτον add. δὲ S; item 16.14 post ἕκτον

16.16 τὸ—μέχρι (16.17) $M^{ac}CP$ τὸ-τεσσάρων (16.20) del. Jan

16.17 ante σύστημα add. καλούμενον U in marg. add. δεκάχορδον N

16.18 πρώτων M; item δευτέρων, τρίτων (16.19) γὰρ ἐν αὐτῷ C^{1pl} γραφῶν M γὰρ αὐτῶν S γράγε Z γὰρ $L^{\gamma\rho}Q$

16.19 τέταρτον τὸ διὰ πασῶν om. M^{ac}

16.20 πασῶν καὶ διὰ τεσσάρων. ὁ δὲ τῆς τόπος
16.21 αὔξεται μέχρι τοῦ ὀγδόου συμφώνου ὅπερ ἐστὶ δὶς
17.1 διὰ πασῶν καὶ διὰ τεσσάρων καὶ δὶς διὰ πασῶν καὶ
17.2 διὰ πέντε. διάφωνα δέ ἐστι τά τε ἐλάττω τῶν διὰ
17.3 τεσσάρων καὶ μεταξὺ τῶν εἰρημένων συμφώνων πάντα.
17.4 Γίνεται δὲ καὶ σχήματα τοῦ αὐτοῦ μεγέθους
17.5 ἐκ τῶν αὐτῶν ἀσυνθέτων συγκείμενα καὶ ἀριθμοῦ,
17.6 εἰ ἡ τάξις αὐτῶν ἀλλοίωσιν λάβοι ἐνυπάρχοντός τινος
17.7 ἀνομοίου· τὰ γὰρ ἐξ ἴσων πάντων ἢ ὁμοίων σχημάτων
17.8 ἀλλοίωσιν οὐ ποιεῖ. τοῦ μὲν οὖν διὰ τεσσάρων
17.9 τρία ἐστιν εἴδη. πρῶτον μὲν τὸ ὑπὸ βαρυπύκνων
17.10 περιεχόμενον, οἷόν ἐστι τὸ ἀπὸ ὑπάτης ὑπάτων
17.11 ἐπὶ ὑπάτων μέσων· δεύτερον τὸ ὑπὸ μεσοπύκνων
17.12 περιεχόμενον, οἷόν ἐστι τὸ ἀπὸ παρυπάτης ὑπάτων ἐπὶ
17.13 παρυπάτην μέσων· τρίτον δὲ τὸ ὑπὸ ὀξυπύκνων περιεχόμενον,
17.14 οἷόν ἐστι τὸ ἀπὸ λιχανοῦ ὑπάτων ἐπὶ λιχανὸν
17.15 μέσων. ἐν μὲν οὖν ἁρμονίᾳ καὶ χρώματι πρὸς
17.16 τὴν τοῦ πυκνοῦ σχέσιν τὰ σχήματα τῶν συμφώνων

16.20 post τεσσάρων add. πέμπτον τὸ διὰ πασῶν καὶ διὰ πέντε. ἕκτον τὸ δὶς διὰ πασῶν U

16.21 δὶς om. M^{ac}CP

17.1 δὶς om. M^{ac}CP

17.5 συγκείμενα P^{1} συγκειμένων MCP ἀριθμοί Z

17.6 εἰ ἡ LV εἰ MP εἴπερ $C^{1}P^{1}$ ἡ M^{1} om. C λάβοιεν ὑπάτων M^{ac}CP

17.9 ὑπὸ] ἀπὸ M 17.11 ὑπάτην] ὑπάτων M^{ac}P

17.13 παρυπάτην] ὑπάτων M^{ac}C

17.15 μέσων] μέσον MC

17.17 λαμβάνεται, ἐν δὲ διατόνῳ ἐπὶ πυκνοῦ οὐ γίνεται,
17.18 διαιρεῖται δὲ τὸ γένος τοῦτο εἰς ἡμιτόνια καὶ τόνους.
17.19 ὑπάρχει δὲ ἐν τῇ διὰ τεσσάρων συμφωνίᾳ ἡμιτόνιον
17.20 μὲν ἕν, τόνοι δὲ δύο· ὁμοίως δὲ κἀν τῷ διὰ πέντε
18.1 ἡμιτόνιον μὲν ἕν, τόνοι δὲ τρεῖς· ἐν δὲ τῷ διὰ πασῶν
18.2 ἡμιτόνια μὲν δύο, τόνοι δὲ πέντε· πρὸς δὲ τὴν τῶν
18.3 ἡμιτονίων σχέσιν τὰ σχήματα θεωρεῖται. τοῦ οὖν διὰ
18.4 τεσσάρων πρῶτον μέν ἐστιν εἶδος οὗ τὸ ἡμιτόνιον ἐπὶ
18.5 τὸ βαρὺ τῶν τόνων κεῖται, δεύτερον δὲ οὗ πρῶτον ἐπὶ
18.6 τὸ ὀξύ, τρίτον οὗ μέσον τῶν τόνων. ἔστι δὲ καὶ
18.7 ταῦτα ὁμοίως τοῖς λοιποῖς γένεσιν ἀπὸ τῶν αὐτῶν
18.8 φθόγγων ἐπὶ τοὺς αὐτους.
18.9 Τοῦ δὲ διὰ πέντε τέσσαρά ἐστι σχήματα. πρῶτον
18.10 μὲν τὸ ὑπὸ βαρυπύκνων περιεχόμενον, οὗ πρῶτος ὁ
18.11 τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ ὑπάτης μέσων ἐπὶ παρα-
18.12 μέσην. δεύτερον δὲ τὸ ὑπὸ μεσοπύκνων περιεχόμενον,
18.13 οὗ δεύτερος ὁ τόνος ἐπὶ τὸ ὀξύ· ἔστι δὲ ἀπὸ
18.14 παρυπάτης μέσων ἐπὶ τρίτην διεζευγμένων. τρίτον δὲ
18.15 τὸ ὑπὸ ὀξυπύκνων περιεχόμενον, οὗ τρίτος ὁ τόνος

17.20 τόνοι] τονιαῖα MC

18.2 πρὸς δὲ τὴν] προσδέοι $M^{ac}C$

18.5-6 πρῶτον ἐπὶ τὸ ὀξὺ] μέσον τῶν τόνων τὸ ὀξὺ U μέσον τοῦ τόνου τὸ ὀξὺ S

18.6 μέσον] μέσων MC μέσον τῶν τόνων] πρῶτον ἐπὶ τὸ ὀξὺ τῶν τόνων M^{1} ἔστι M^{1}CP ἔχει M]18.7 ante γένεσιν add. τὴν M^{1} τοῖς SS

18.9 τοῦ] τοῦτο $M^{ac}C$

18.13 οὗ] οὐ M ἔστι δὲ M^{1}CP ἔστιν M

18.16 ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ λιχανοῦ μέσων ἐπὶ παρανήτην
18.17 διεζευγμένων. τέταρτον δὲ τὸ ὑπὸ βαρυπύκνων περιεχόμενον,
18.18 οὗ τέταρτος ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ
18.19 μέσης ἐπὶ νήτην διεζευγμένων ἢ ἀπὸ προσλαμβανομένου
18.20 ἐπὶ ὑπάτην μέσων. ἐν δὲ διατόνῳ πρῶτον μέν
19.1 ἐστι σχῆμα οὗ πρῶτον τὸ ἡμιτόνιον ἐπὶ τὸ βαρὺ κεῖται,
19.2 δεύτερον δὲ οὗ πρῶτον ἐπὶ τὸ ὀξὺ τρίτον οὗ δεύτερον
19.3 ἐπὶ τὸ ὀξύ, τέταρτον οὗ τρίτον ἐπὶ τὸ ὀξύ.
19.4 Τοῦ δὲ διὰ πασῶν εἴδη ἐστὶν ἑπτά. πρῶτον μὲν
19.5 τὸ ὑπο βαρυπύκνων περιεχόμενον, οὗ πρῶτος ὁ τόνος
19.6 ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ ὑπάτης ὑπάτων ἐπὶ παραμέσην,
19.7 ἐκαλεῖτο δὲ ὑπὸ τῶν ἀρχαίων μιξολύδιον.
19.8 δεύτερον τὸ ὑπὸ μεσοπύκνων περιεχόμενον οὗ
19.9 δεύτερος ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ παρυπάτης
19.10 ὑπάτων ἐπὶ τρίτην διεζευγμένων, ἐκαλεῖτο δὲ λύδιον.
19.11 τρίτον τὸ ὑπο ὀξυπύκνων περιεχόμενον, οὗ τρίτος
19.12 ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ λιχανοῦ ὑπάτων ἐπὶ
19.13 παρανήτην διεζευγμένων, ἐκαλεῖτο δὲ φρύγιον.
19.14 τέταρτον τὸ ὑπὸ βαρυπύκνων περιεχόμενον, οὗ
20.1 τέταρτος ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ ὑπάτης
20.2 μέσων ἐπὶ νήτην διεζευγμένων, ἐκαλεῖτο δὲ δώριον.

18.17 δὲ U om. cett.

18.18 τέταρτος codd. πρῶτος Jan ὀξύ M^1, cf. 20.22, 21.1 βαρύ P ἐπὶ τὸ ὀξύ om. $M^{ac}C$ 18.19 προσλαμβανομένων M

18.20 ὑπάτη P ἐν δὲ—ὀξύ (alterum 19.3) om. Q

19.1 οὗ—ὀξὺ (prius 19.3) om. MC

19.3 οὗ] οὐ M τρίτον codd. πρῶτον Jan ὀξύ (alterum) Meibom; cf. 18.18 βαρύ codd.

20.3 πέμπτον τὸ ὑπὸ μεσοπύκνων περιεχόμενον οὗ
20.4 πέμπτος ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ παρυπάτης
20.5-6 μέσων ἐπὶ τρίτην ὑπερβολαίων, ἐκαλεῖτο δὲ ὑπολύδιον.
20.7 ἕκτον τὸ ὑπὸ ὀξυπύκνων περιεχόμενον, οὗ ἕκτος
20.8 ὁ τόνος ἐπὶ τὸ ὀξύ. ἔστι δὲ ἀπὸ λιχανοῦ μέσων ἐπὶ
20.9 παρανήτην ὑπερβολαίων, ἐκαλεῖτο δὲ ὑποφρύγιον.
20.10 ἕβδομον τὸ ὑπὸ βαρυπύκνων περιεχόμενον, οὗ
20.11 πρῶτος ὁ τόνος ἐπὶ τὸ βαρύ. ἔστι δὲ ἀπὸ μέσης ἐπὶ
20.12 νήτην ὑπερβολαίων ἢ ἀπὸ προσλαμβανομένου ἐπὶ μέσην,
20.13 ἐκαλεῖτο δὲ κοινὸν καὶ λοκριστὶ καὶ ὑποδώριον.
20.14 Ἐν δὲ διατόνῳ πρῶτον μέν ἐστιν εἶδος τοῦ διὰ
20.15 πασῶν, οὗ πρῶτον μὲν ἐπὶ τὸ βαρύ, τέταρτον δὲ ἐπὶ
20.16 τὸ ὀξύ ἐστι τὸ ἡμιτόνιον. δεύτερον δὲ οὗ τρίτον μὲν
20.17 ἐπὶ τὸ βαρύ, πρῶτον δὲ ἐπὶ τὸ ὀξύ. τρίτον δὲ οὗ
20.18 δεύτερον ἐφ' ἑκάτερα. τέταρτον δὲ οὗ πρῶτον μὲν ἐπὶ
20.19 τὸ βαρύ, τρίτον δὲ ἐπὶ τὸ ὀξύ. πέμπτον δὲ οὗ τέταρτον
20.20 μὲν ἐπὶ τὸ βαρύ, πρῶτον δὲ ἐπὶ τὸ ὀξύ. ἕκτον δὲ

20.8 ἐπὶ (alterum) ἢ C

20.13 λοκριστὶ C λοκρικὸν MC^1P^1 λοκριστικὸν P

20.14 post δὲ add. τῷ M^1 τοῦ C^1 τὸ cett.

20.15 οὗ] οὐ M μὲν ἐπὶ τὸ βαρύ] τε καὶ $M^{ac}CP$ δε επι τὸ ὀξύ ἐστι] ἐπὶ $M^{ac}CP$

20.16 τρίτον—βαρύ (20.17) om. CP

20.17 πρῶτον] ἕβδομον U

20.19 τρίτον] πρῶτον Z τέταρτον CP(corr. C^1P^1) πέμπτον—βαρύ (20.20) transp. ad 20.20 (post ὀξύ) P^1 πέμπτον—ὀξύ (20.21) om. C (add. C^1) 20.20 πρῶτον δὲ] τέταρτον M^{ac} δεύτερον U ἕβδομον Q δὲ οὗ τρίτον—δεύτερον δὲ (20.21)] δεύτερον δὲ, πέμπτον V

οὗ τρίτον μὲν ἐπὶ τὸ βαρύ, δεύτερον δὲ ἐπὶ τὸ ὀξύ.

ἕβδομον δὲ οὗ δεύτερον μὲν ἐπὶ τὸ βαρύ, τρίτον δὲ ἐπὶ τὸ ὀξύ. ἔστι δὲ καὶ ταῦτα ἀπὸ τῶν αὐτῶν φθόγγων τοῦ χρώματος καὶ ἐκαλεῖτο τοῖς αὐτοῖς ὀνόμασι.

Τῇ δὲ τοῦ ῥητοῦ καὶ ἀλόγου διαφορᾷ διοίσει συστήματα, ὅσα ἐκ ῥητῶν διαστημάτων σύγκειται, τῶν ἐξ ἀλόγων. ὅσα μὲν γὰρ ῥητα ἐκ ῥητῶν ἐστιν, ὅσα δὲ ἐξ ἀλόγων ἄλογα.

Τῇ δὲ τοῦ ἐξῆς καὶ ὑπερβατοῦ διαφορᾷ διοίσει συστήματα τὰ διὰ τῶν ἐξῆς φθόγγων μελῳδούμενα τῶν κατὰ ὑπερβατόν.

Τῇ δὲ τοῦ συνημμένου καὶ διεζευγμένου διαφορᾷ διοίσει συστήματα, ὅσα διὰ τῶν συνημμένων τετραχόρδων τὴν σύνθεσιν ἔχει τῶν διεζευγμένων.

ἔστι δὲ συναφὴ μὲν δύο τετραχόδων ἐξῆς μελῳδουμένων, ὁμοίων κατὰ σχῆμα, φθόγγος κοινός.

διάζευξις δέ ἐστι δύο τετραχόρδων ἐξῆς μελῳδουμένων, ὁμοίων κατὰ σχῆμα, τόνος ἀνὰ μέσον. εἰσι δὲ αἱ

20.21 τρίτον] πρότερον Z μέν--βαρὺ om. M(ut vid.) P δεύτερον] ἕκτον Q

20.22 δεύτερον] πρότερον Z βαρὺ] ὀξὺ MCP τρίτον] δεύτερον Z πέμπτον U

21.1 ὀξύ] βαρύ CP 21.5 τῶν] ἢ Z

21.6 ἀλόγων] ἀναλόγων C ῥητὰ ἐκ ῥητῶν codd. ἐκ ῥητῶν ῥητά Jan

21.7 δὲ ἄλογα· ἐξ ἀλόγων invert. Q

21.9 τὰ om. M^{ac} 21.10 τῶν Q τῇ cett. κατὰ ὑπερβατόν] δι' ὑπερβατῶν Meibom 21.12 ante συνημμένων add. διέσεων MCP 21.13 post τῶν add. διὰ τῶν Q

21.17 μέσων C πᾶσαι αἱ invert. Q

21.18 πᾶσαι συναφαὶ τρεῖς· βαρυτάτη, μέση, ὀξυτάτη. καὶ
22.1 ἔστι βαρυτάτη μὲν ἡ ἐκ τοῦ ὑπάτων καὶ μέσων τετρα-
22.2 χόρδου· κοινὸς δὲ αὐτὰ συνάπτει φθόγγος ὑπάτη
22.3 μέσων. μέση δέ ἐστι συναφὴ ἐκ τοῦ μέσων καὶ νητῶν
22.4 συνημμένων· κοινὸς δὲ αὐτα συνάπτει φθόγγος μέση.
22.5 ὀξυτάτη δέ ἐστι συναφὴ ἐκ τοῦ διεζευγμένων καὶ
22.6 ὑπερβολαίων· κοινὸς δὲ αὐτὰ συνάπτει φθόγγος νήτη
22.7 διεζευγμένων. διάζευξις δέ ἐστι μία ἐκ τοῦ μέσων καὶ
22.8 νητῶν διεζευγμένων· κοινὸς δὲ αὐτὰ διεζεύγνυσι τόνος
22.9 ὁ μεταξὺ μέσης καὶ παραμέσης.
22.10 Τέλεια δέ ἐστι συστήματα δύο, ὧν τὸ μὲν ἔλαττον,
22.11 τὸ δὲ μεῖζον. καὶ ἔστι τὸ μὲν ἔλαττον κατὰ
22.12 συναφὴν ἀπὸ προσλαμβανομένου ἐπὶ νήτην συνημμένων.
22.13 ὑπάρχει δὲ ἐν αὐτῳ τετράχορδα τρία συνεμμένα
22.14 τάδε· ὑπάτων, μέσων, συνημμένων, καὶ τόνος ἀπὸ προσ-
22.15 λαμβανομένου ἐπὶ ὑπάτην· συμφώνῳ δὲ ὁρίζεται

21.18 βαρυτάτη hab. ante μέση Q post ὀξυτάτη cett.

22.1 ἐκ del. Jan τετραχόρδων C^1

22.2 αὐτὰ $M^1C^1P^1$ αὐτῇ MCP post ὑπάτη add. τῶν C^1

22.3 ἐκ] ἡ ἐκ C^1 ἡ Jan νητῶν MCP om. U

22.4 συνημμένη M αὐτὰ M^1P; item 22.6 αὐτῇ MC ante μέση add. ἡ C^1

22.5 ἐκ] ἡ ἐκ C^1P ἡ Jan

22.6 ante ὑπερβολαίων add. τοῦ V ante νήτη add. ἡ C^1

22.7 ἐκ] ἡ ἐκ C^1P ἡ Jan 22.8 νητῶν] τῶν C^1 αὐτὰ P αὐτὴν cett. 22.10 ὧν om. P 22.12 νήτη MC

22.14 ὑπάτων] ὑπὸ τῶν C

22.15 συμφώνῳ U σύμφωνον MC συμφώνων Vat. Barb. 265 -ου C^1

22.16 τῷ διὰ πασῶν καὶ διὰ τεσσάρων.

22.17 τὸ δὲ μεῖζόν ἐστι διάζευξιν ἀπὸ προσλαμβανομένου

23.1 ἐπὶ νήτην ὑπερβολαίων. ὑπάρχει δὲ ἐν αὐτῷ

23.2 τετράχορδα μὲν τέσσαρα διὰ δυοῖν διεζευγμένα, ἀλλήλοις

23.3 δὲ συνημμένα, τό τε ὑπάτων καὶ μέσων, καὶ διεζευγ-

23.4 μένων καὶ ὑπερβολαίων, καὶ ἔτι τόνοι δύο, ὅ τε

23.5 ἀπὸ προσλαμβανομένου ἐπὶ ὑπάτην ὑπάτων καὶ ὁ ἀπὸ

23.6 παραμέσης ἐπὶ μέσην. συμφώνῳ δὲ ὁρίζεται τῷ δὶς

23.7 διὰ πασῶν.

23.8 πέντε δὲ ὄντων τετραχόρδων ἐν τῷ ἀμεταβόλῳ

23.9 συστήματι, ὅπερ ἐστὶν ἐξ ἀμφοῖν τελείοιν σύνθετον,

23.10 τὰ μὲν δύο κοινά ἐστιν ἑκατέρων τῶν τελείων, τό τε

23.11 ὑπάτων καὶ μέσων· ἴδια δὲ τοῦ μὲν κατὰ συναφὴν τὸ

23.12 νητῶν συνημμένων, τοῦ δὲ κατὰ διάζευξιν τὸ νητῶν

23.13 διεζευγμένων καὶ νητῶν ὑπερβολαίων.

23.14 Ἴδῃ δὲ τοῦ ἀμεταβόλου καὶ ἐμμεταβόλου

23.15 διοίσει, καθ' ἣν διαφέρει τὰ ἁπλᾶ συστήματα τῶν

23.16 μὴ ἁπλῶν. ἁπλᾶ μὲν οὖν ἐστι τὰ πρὸς μίαν μέσην

22.16 τῷ C τὸ M

23.3 καὶ (alterum) om. C

23.6 παραμέσης ἐπὶ μέσην] μέσης ἐπὶ παραμέσην Q συμφώνῳ M^1C^1 συμφώνων MC ὁρίζεται M^1P^1 διορίζεται MCP τῷ] τὸ S

23.8 post ὄντων add. τῶν Q ἐμμεταβόλῳ M^1

23.10 ἑκατερῷ C^1

23.11 τὸ] τῶν $M^{ac}C$

23.12 νητῶν (bis) τῶν Meibom; item 23.13 τὸ]τῶν $M^{ac}C$

23.17 ἡρμοσμένα, διπλᾶ δὲ τὰ πρὸς δύο, τριπλᾶ δὲ τὰ πρὸς
23.18 τρεῖς, πολλαπλάσια δὲ τὰ πρὸς πλείονας. ἔστι δὲ
23.19 μέση, φθόγγου δύναμις, ᾧ συμβέβηκε κατὰ μὲν διάζευξιν
23.20 ἐπὶ μὲν τὸ ὀξὺ τόνον ἔχειν ἀσύνθετον ἀπαθοῦς
23.21 ὄντος τοῦ συστήματος, ἐπὶ δὲ τὸ βαρὺ δίτονον ἤτοι σύνθετον
23.22 ἢ ἀσύνθετον. κατὰ δὲ συναφήν, ᾧ
24.1 συμβαίνει τριῶν τετραχόρδων συνημμένων ἤτοι τοῦ
24.2 μέσου ὀξυτάτῳ εἶναι, ἢ τοῦ ὀξυτάτου βαρυτάτῳ.
24.3 ἀπὸ δὲ τῆς μέσης καὶ τῶν λοιπῶν φθόγγων αἱ
24.4 δυνάμεις γνωρίζονται, τὸ γὰρ πῶς ἔχειν ἕκαστον
24.5 αὐτῶν πρὸς τὴν μέσην φανερῶς γίνεται.
24.6 Τόνος δὲ λέγεται τετραχῶς· καὶ γὰρ ὡς φθόγγος
24.7 καὶ διάστημα καὶ ὡς τόπος φωνῆς καὶ ὡς
24.8 τάσις. ἐπὶ μὲν οὖν τοῦ φθόγγου χρῶνται τῷ ὀνόματι
24.9 οἱ λέγοντες ἑπτάτονον τὴν φόρμιγγα καθάπερ

23.17 τρι/πλα(in duabus manibus)$M^{ac}C^{1}$

23.19 φθόγγος P

23.20 ὀξύτονον (un. verb.) V ἔχει $M^{ac}C$ ἀπαθοῦς--σύνθετον (23.21) om. MC ἀπαθοῦς--ἀσύνθετον (23.22) om. $C^{1}P^{1}$ ἀπαθοῦς ὄντος U ἀπαθῆ ὄντα Jan

24.1 μεταχόρδων U

24.2 ὀξυτάτῳ] ὀξυτάτου U ἢ] ἤτοι Jan

24.3 αἱ om. $M^{ac}CP$

24.4 δύναμις $M^{ac}C$

24.6 ante τόνος add. titulum Περὶ τόνου Neap. 260(f. 55^{r}-63^{v})

24.7 ante διάστημα add. ὡς Z

24.10 Τέρπανδρος καὶ Ἴων. ὁ μὲν γάρ φησιν·

24.11 ἡμεῖς τοι τετράγηρυν ἀποστέρξαντες ἀοιδὰν

24.12 ἑπτατόνῳ φόρμιγγι νέους κελαδήσομεν ὕμνους.

24.13 ὁ δὲ·

24.14 ἐνδεκάχορδε λύρα, δεκαβάμονα τάξιν ἔχουσα

24.15 εἰς συμφωνούσας ἁρμονίας τριόδους·

24.16 πρὶν μέν σ' ἑπτάτονον ψάλλον δὶς τέσσαρα πάντες

24.17 Ἕλληνες σπανίαν μοῦσαν ἀειράμενοι.

25.1 καὶ ἕτεροι δὲ οὐκ ὀλίγοι κέχρηνται τῷ ὀνόματι. ἐπὶ

25.2 δὲ τοῦ διαστήματος, ὅταν λέγωμεν ἀπὸ μέσης ἐπὶ

25.3 παραμέσην τόνον εἶναι·

25.4 Ὁ δὲ ὡς τόπος φωνῆς, ὅταν λέγωμεν δώριον ἢ

25.5 φρύγιον ἢ λύδιον ἢ τῶν ἄλλων τινά. εἰσὶ δὲ κατὰ

25.6 Ἀριστόξενον δεκατρεῖς·

25.7 ὑπερμιξολύδιος καὶ ὑπερφρύγιος καλούμενος.

25.8 μιξολύδιοι δύο, ὀξύτερος καὶ βαρύτερος, ὧν ὁ

24.11 ἡμεῖς τοι] σοὶ δ' ἡμεῖς Bergk^{2}

24.12 νεούς om. M^{ac} κελαδήσωμεν M

24.14 ἐνδεκάχορδε Bergk^{2} ἐνδεκαχόρδῳ Bergk^{3} ἐν δεκάχορδε M ἑνδεκαχόρδῳ cett. λύρα] τὴν U λύρα τὴν MCP ἔχουσα Wilamowitz ἔχοις ἀεὶ MCPL ἔχεις ἀεὶ S ἔχουσα Meibom

24.15 εἰς Wilamowita εἶ Diels εἰ Menge τὰς codd. τρεῖς Marx τῶν (συμφωνουσῶν ἁρμονιῶν) Reinach τριόδους S τριώδους cett. τέτορος Reinach-Weil

24.16 σ'] οὖν U δὶς Pena διὰ codd. τεσσάρων L

25.2 λέγωμεν in ras. M^{1}

25.4 τόπος φ. ὅταν λέγ. Jan τόπος ὅταν λέγ. φ. codd.

25.6 δεκατρεῖς Q ιγ cett. τρισκαίδεκα Meibom post δεκατρεῖς add. τόνοι QU

25.7 καὶ] ὁ καὶ C^{1}P^{1}

25.9 ὀξύτερος καὶ ὑπεριάστιος καλεῖται, ὁ δὲ βαρύτερος

25.10 καὶ ὑπερδώριος.

25.11 λύδιοι δύο, ὀξύτερος καὶ βαρύτερος, ὧν ὁ βαρύτερος

25.12 καὶ αἰόλιος καλεῖται.

26.1 φρύγιοι δύο, ὀξύτερος καὶ βαρύτερος, ὧν ὁ βαρύτερος

26.2 καὶ ἰάστιος καλεῖται.

26.3 δώριος εἷς.

26.4 ὑπολύδιοι δύο, ὀξύτερος καὶ βαρύτερος, ὧν ὁ βαρύτερος καὶ

26.5 ὑποαιόλιος καλεῖται.

26.6-7 ὑποφρύγιοι δύο, ὧν ὁ βαρύτερος καὶ ὑποιάστιος καλεῖται

26.8 ὑποδώριος.

26.9 τούτων βαρύτατος μὲν ὁ

26.10 ὑπὸ δώριος. οἱ δὲ ἑξῆς οἱ ἀπὸ τοῦ ὀξυτάτου

26.11 μέχρι τοῦ βαρυτάτου ἡμιτονίῳ ἀλλήλων ὑπερέχοντες,

26.12 παράλληλοι δὲ δύο τριημιτονίῳ.

25.9 καὶ ὑποιάστιος M^{ac}

25.11 λύδιοι δὲ δύο Meibom ὧν ὁ βαρύτερος om. MU

26.1 φρύγιοι—καλεῖται (26.2) om. M^{ac} ὀξύτερος--καλεῖται (26.2)] ὁ μὲν, βαρὺς ὃς καὶ ἰαστιος, ὁ δὲ ὀξυς M^{1} ὧν ὁ βαρύ.--καὶ (alterum 26.4) om. C

26.4 ὧν ὁ βαρύτερος P^{1} ὃς cett.

26.5 post καλεῖται add. καὶ ἰάστιος καλεῖται ὧν ὁ βαρύτερος C^{2}

26.7 καλεῖται καὶ ὑποδώριος U

26.9 βαρύτατος ego ὀξύτατος codd. post μὲν add. ὁ $C^{1}P^{1}$ om. cett. post ὁ add. ὑπερμιξολύδιος, βαρύτατος δὲ ὁ ὑπο- Jan add. solum ὑπο- ego

26.10 τοῦ ὀξυτάτου Q τῶν ὀξυτάτων cett.

26.11 ἡμιτονίῳ $M^{1}P^{1}$ ἡμιτόνιον MCP ὑπερέχοντες om. MCP

26.12 παράλληλοι—τριημιτονίῳ om. Q post δύο add. τόνον, οἱ δὲ τρίτοι Jan τριημιτονίῳ $M^{1}P$ -τόνιον MC fort. ἡμιτονίῳ aut

26.13 ἀναλόγως δὲ ἔξει καὶ ἐπὶ τῆς τῶν λοιπῶν τόνων δια-
26.14 στάσεως. ὁ δὲ ὑπερμιξολύδιος τοῦ ὑποδωρίου τῷ διὰ
26.15 πασῶν ἐστιν ὀξύτερος.
26.16 Ὁ δὲ ὡς τάσις τόνος λέγεται, καθ' ὃ φαμεν ὀξυτονεῖν
26.17-18 τινα ἢ βαρυτονεῖν ἢ μέσῳ τῷ τῆς φωνῆς τόνῳ κεχρῆσθαι.
26.19 Μεταβολὴ δὲ λέγεται τετραχῶς· καὶ γὰρ
27.1 κατὰ γ'νος καὶ κατὰ σύστημα καὶ κατὰ τόνον καὶ κατὰ
27.2 μελοποιίαν. κατὰ μὲν οὖν γένος γίνεται μεταβολὴ,
27.3 ὅταν ἐκ διατόνου εἰς χρῶμα ἢ ἁρμονίαν, ἢ ἐκ χρώματος
27.4 ἢ ἁρμονίας εἴς τι τῶν λοιπῶν μεταβολὴ γένηται.
27.5 κατὰ σύστημα δὲ, ὅταν ἐκ συναφῆς εἰς διάζευξιν ἢ
27.6 ἀνάπαλιν μεταβολὴ γένηται. κατὰ τόνον δὲ, ὅταν ἐκ
27.7 δωρίων εἰς φρύγια, ἢ ἐκ φρυγίων εἰς λύδια ἢ ὑπερ-
27.8 μιξολύδια ἢ ὑποδώρια, ἢ καθόλου ὅταν ἓν τινος τῶν
27.9 δεκατριῶν τόνων εἰς τινα τῶν λοιπῶν μεταβολὴ
27.10 γένηται. γίνονται δὲ μεταβολαὶ ἀπὸ τοῦ ἡμιτονίου,
27.11 ἀρξάμεναι μέχρι τοῦ διὰ πασῶν, ὧν αἱ μὲν
27.12 κατὰ σύμφωνα γίνονται διαστήματα, αἱ δὲ κατὰ διά-
27.13 φωνα. τούτων δ' ἐμμελεῖς μὲν αἵ τε κατὰ σύμφωνα
27.14 γινόμενα διαστήματα καὶ ἡ τονιαία. τῶν δὲ λοιπῶν

τόνοι καὶ ἡμιτονίῳ

26.14 ὑπομιξολύδιος M^{ac}(ut vid.) 27.2 μελωποιίαν M^{ac}

27.10 ante μεταβολαὶ add. αἱ Meibom τοῦ ἡμιτονίου ego τῆς ἡμιτονίας codd. τῆς ἡμιτονιαίας Jan

27.11 ἀρξάμεναι $C^{1}P$ ἀρξαμέναις M -ης M^{1} -ος Q

27.12 hab. αἱ δὲ κατὰ διάφωνα ut titulum M

27.13 ἐμμελεῖς--λοιπῶν (27.14) om. U αἵ τε—ἧττον (27.15)

27.15 αἱ μὲν ἧττον ἐμμελεῖς, αἱ δὲ μᾶλλον.

27.16 ἐν ὅσαις μὲν οὖν αὐτῶν πλείων

27.17 ἡ κοινωνία, ἐμμελέστεραι·

27.18 ἐπειδὴ ἀναγκαῖον πάσῃ μεταβολῇ κοινόν

27.19 τι ὑπάρχειν ἢ φθόγγον ἢ διάστημα ἢ σύστημα. λαμ-

27.20 βάνεται δὲ ἡ κοινωνία καθ' ὁμοιότητα φθόγγων· ὅταν

27.21 γὰρ ἐπ' ἀλλήλους ἐν ταῖς μεταβολαῖς πέσωσιν ὅμοιοι

28.1 φθόγγοι κατὰ τὴν τοῦ πυκνοῦ μετοχήν, ἐμμελὴς γίνεται

28.2 ἡ μεταβολή, ὅταν δὲ ἀνόμοιοι, ἐκμελής.

28.3 Κατὰ δὲ μελοποιΐαν γίνεται μεταβολή, ὅταν ἐκ

28.4 διασταλτικοῦ ἤθους εἰς συσταλτικὸν ἢ ἡσυχαστικόν, ἢ

28.5 ἐξ ἡσυχαστικοῦ εἴς τι τῶν λοιπῶν ἡ μεταβολὴ γένηται.

28.6 ἔστι δὲ διασταλτικὸν μὲν ἦθος μελοποιίας, δι' οὗ

28.7 σημαίνεται μεγαλοπρέπεια καὶ δίαρμα ψυχῆς ἀνδρώδες

28.8 καὶ πράξεις ἡρωϊκαὶ καὶ πάθη τούτοις οἰκεῖα. χρῆται

28.9 δὲ τούτοις μάλιστα μὲν ἡ τραγῳδία καὶ τῶν λοιπῶν

28.10 δὲ ὅσα τούτου ἔχεται τοῦ χαρακτῆρος συσταλτικὸν δὲ,

28.11 δι' οὗ συνάγεται ἡ ψυχὴ εἰς ταπεινότητα καὶ ἄνανδρον

27.15 ἧττον ἐκμελεῖς P ἐμμελεῖς ἧττον η ἐκμελεῖς $M^{1}P^{1}$ ἄσσον ἐμμελεῖς ἧττον ἢ ἐκ. Jan

27.17 post ἐμμελέστεραι add. εἰσιν Jan add. ἐν ὅσαις δὲ ἐλάττων, ἐκμελέστεραι $M^{1}P^{1}C^{2}$

28.2 δὲ om. $M^{1}C$ ἐκμελεῖς M^{ac}

28.3 ὅταν δὲ ἐκ L

28.4 διασταλτικοῦ Lugdunensis Perizonianus F. 41 διαστατικοῦ MCP διαστηματικοῦ M^{1} συστατικὸν $M^{ac}C$ ante ἡσυχαστικὸν add. εἰς Q

28.5 ἡσυχαστικῶν C

28.6 διασταλτικὸν Jan διαστατικὸν $C^{2}P^{1}$ διαστηματικὸν CPL διαστιματικὸν M

διάθεσιν. ἁρμόσει δὲ τὸ τοιοῦτον κατάστημα τοῖς
ἐρωτικοῖς πάθεσι καὶ θρήνοις καὶ οἴκτοις καὶ τοῖς
παραπλησίοις. ἡσυχαστικὸν δὲ ἦθός ἐστι μελοποιίας,
ᾧ παρέπεται ἡρεμότης ψυχῆς καὶ κατάστημα ἐλευθέριόν
τε καὶ εἰρηνικόν. ἁρμόσουσι δὲ αὐτῷ ὕμνοι
παιᾶνες ἐγκώμια συμβουλαὶ καὶ τὰ τούτοις ὅμοια.

Μελοποιία ἐστὶ χρῆσις τῶν προειρημένων
μερῶν τῆς ἁρμονικῆς καὶ ὑποκειμένων δύναμιν ἐχόντων.
δι' ὧν δὲ μελοποιία ἐπιτελεῖται $\bar{\delta}$ ἐστιν· ἀγωγὴ
πλοκὴ πετteία τονή. ἀγωγὴ μὲν οὖν ἐστιν ἡ διὰ τῶν
ἑξῆς φθόγγων ὁδος τοῦ μέλους, πλοκὴ δὲ ἡ ἐναλλὰξ
τῶν τε διαστημάτων θέσις παράλληλος, πετteία δὲ ἡ ἐφ'
ἑνὸς τόνου πολλάκις γινομένη πλῆξις, τονὴ δὲ ἡ ἐπὶ
πλείονα χρόνον μονὴ κατὰ μίαν γινομένη προφορὰν
τῆς φωνῆς.

{Διάγραμμα δὲ σχῆμα ἐπίπεδον τὰς τῶν μελῳδουμένων
περιέχον δυνάμεις.

Δύναμις δέ ἐστι τάξις φθόγγου ἐν συστήματι, ἢ

28.12 κατά///στημα M^1

28.20 μερῶν—ὑποκειμένων om. $M^{ac}C$ 29.1 $\bar{\delta}$ τέσσαρα P

29.2 ἡ om. $M^{ac}C$ 29.4 τε MCP om. cett.

29.5 γινομένου C

29.7 post φωνῆς fin. isagoges et add. A.Q. 28.10-30.17 (διορθοῦτο) Q tabulae in N et Vat,]346

29.8-15 del. Jan

29.10 ante δύναμις add. titulum Εἰσαγωγὴ ἁρμονικὴ Εὐκλείδου
MZ add. in marg. Περὶ δυνάμεως Neap. 260 (f. 55^r- 63^v) ἢ] ἡ M

29.11 δύναμίς ἐστι τάξις φθόγγου, δι' ἧς γνωρίζομεν τῶν

29.12 φθόγγων ἕκαστον.

29.13 Μελοποιία δέ ἐστι χρῆσις τῶν ὑποκειμένων τῇ

29.14-15 ἁρμονικῇ πραγματείᾳ πρὸς τὸ οἰκεῖον ἑκάστης ὑποθέσεως.

29.16 Οὗτος ὁ ὅρος τῆς κατὰ τὸ ἡρμοσμένον ἐστὶ πραγ-

29.17 ματείας.

29.13-15 fort. omittenda; cf. 2.8-10

29.17 post πραγματείας add. Εὐκλείδου εἰσαγωγὴ ἁρμονική U add. περὶ φθόγγων (ante Sectionem canonis) C

Cleonides

Introduction to Harmonics

1.3 Harmonics is both the theoretical and practical science of the nature of harmony. Harmony is that which is composed of both notes and intervals which have some regular arrangement. The study of harmonics consists of seven parts: On Notes; On Intervals; On Genera; On Systems; On Tones; On Modulation; On Melodic Composition.

1.9 A note is the melodic incidence of musical sound at one tuning. An interval is that which is bounded by two notes dissimilar in highness and lowness. A genus is a particular division of four notes. A sytem is that which is composed from more than one interval. A tone is a certain compass of the voice which can contain a system and which is without breadth. Modulation is the transposition of something similar into a dissimilar location. Melodic composition is the employment of the established properties of harmonic practice with regard to what is proper for each subject.

2.11 The following matters are to be considered in researching the quality of sound; the quality of sound consists of two movements--that known as both "continuous" and "spoken," and that known as both "intervallic" and "melodic." Continuous vocal movement renders its tightenings and loosenings undistinguishable, and it does not stand still until it becomes silent. [2.16] Intervallic vocal movement moves in the opposite way from continuous movement, for intervallic movement produces pauses and the spaces between these pauses, and it makes these

pauses and spaces alternately. We call the pauses "pitches," and we call the distances between the pitches "intervals." Tightening and loosening are the processes which produce the difference between pitches; the results of tightening and loosening are highness and lowness, [3.3] for the process of tightening leads toward highness and the process of loosening towards lowness. Highness is the result of tightening, and lowness the result of loosening, for both highness and lowness are affected by tension. [3.7] Pitches are also called "notes"; they are called "pitches" when they are produced on percussion instruments by means of tension, and "notes" when they are produced by the voice. The number of notes is infinite when they are considered as pitches, but when their functions are taken into account there are eighteen in each genus.

3.13 There are three genera--diatonic, chromatic, and enharmonic. The diatonic genus is constructed of whole tone plus whole tone plus halftone when descending, but in the opposite way when ascending--halftone plus whole tone plus whole tone. The chromatic is constructed of trihemitone plus halftone plus halftone when descending, but in the opposite way when ascending--halftone plus halftone plus trihemitone. The enharmonic is constructed of ditone plus quartertone plus quartertone when descending, but in the opposite way when ascending--quartertone plus quartertone plus ditone.

4.4 These are the notes in the diatonic genus: proslambanomenos, hypate hypaton, parhypate hypaton, diatonic lichanos hypaton, hypate meson, parhypate meson, diatonic lichanos meson, mese, trite synemmenon, diatonic paranete synemmenon, nete synemmenon, paramese, trite diezeugmenon, diatonic paranete diezeugmenon, nete diezeugmenon, trite hyper-

bolaion, diatonic paranete hyperbolaion, nete hyperbolaion.

5.1 These are the notes in the chromatic genus: proslambanomenos, hypate hypaton, parhypate hypaton, chromatic lichanos hypaton, hypate meson, parhypate meson, chromatic lichanos meson, mese, trite synemmenon, chromatic paranete synemmenon, nete synemmenon, paramese, trite diezeugmenon, chromatic paranete diezeugmenon, nete diezeugmenon, trite hyperbolaion, chromatic paranete hyperbolaion, nete hyperbolaion.

5.20 These are the notes in the enharmonic genus: proslambanomenos, hypate hypaton, parhypate hypaton, enharmonic lichanos hypaton, hypate meson, parhypate meson, enharmonic lichanos meson, mese, trite synemmenon, enharmonic paranete synemmenon, nete synemmenon, paramese, trite diezeugmenon, enharmonic paranete diezeugmenon, nete diezeugmenon, trite hyperbolaion, enharmonic paranete hyperbolaion, nete hyperbolaion.

6.11 These are the notes in a mixture of the genera: proslambanomenos, hypate hypaton, parhypate hypaton, enharmonic lichanos hypaton, chromatic lichanos hypaton, diatonic lichanos hypaton, hypate meson, parhypate meson, enharmonic lichanos meson, chromatic lichanos meson, diatonic lichanos meson, mese, trite synemmenon, enharmonic paranete synemmenon, chromatic paranete synemmenon, diatonic paranete synemmenon, nete synemmenon, paramese, trite diezeugmenon, enharmonic paranete diezeugmenon, chromatic paranete diezeugmenon, diatonic paranete diezeugmenon, nete diezeugmenon, trite hyperbolaion, enharmonic paranete hyperbolaion, chromatic paranete hyperbolaion, diatonic paranete hyperbolaion, nete hyperbolaion.

7.16 Some of the enumerated notes are fixed, others movable. Fixed notes are those notes which do not participate in the differences

between genera; they remain on one pitch. Movable notes are those which act in the opposite way, for they do participate in the differences between genera, and they do not remain on the same pitch. These are the eight fixed notes: proslambanomenos, hypate hypaton, hypate meson, mese, nete synemmenon, paramese, nete diezeugmenon, and nete hyperbolaion. The movable notes are those notes lying between these.

8.1 Some of the fixed notes are barypyknoi, and some are apyknoi and bound the perfect systems. These are the five barypyknoi: hypate hypaton, hypate meson, mese, paramese, and nete diezeugmenon. These remaining three notes are apyknoi which bound the perfect systems: proslambanomenos, nete synemmenon, and nete hyperbolaion.

8.8 Some of the movable notes are mesopyknoi, some are oxypyknoi, and some are diatonic. These are the five mesopyknoi: parhypate hypaton, parhypate meson, trite synemmenon, trite diezeugmenon, and trite hyperbolaion. Similarly, there are five oxypyknoi in each genus. The enharmonic oxypyknoi are in the enharmonic genus, the chromatic oxypyknoi in the chromatic genus; the diatonic genus does not participate in the pyknon. These are the oxypyknoi in the enharmonic genus: enharmonic lichanos hypaton, enharmonic lichanos meson, enharmonic paranete synemmenon, enharmonic paranete diezeugmenon, and enharmonic paranete hyperbolaion. [8.18] These are the oxypyknoi in the chromatic genus: chromatic lichanos hypaton, chromatic lichanos meson, chromatic paranete synemmenon, chromatic paranete diezeugmenon, and chromatic paranete hyperbolaion. These are the diatonic: diatonic lichanos hypaton, diatonic lichanos meson, diatonic paranete synemmenon, diatonic lichanos diezeugmenon, and diatonic lichanos hyperbolaion.

9.3 Intervals differ in five ways; intervals differ from one

another in size, by genus, in being consonant or dissonant, in being composite or non-composite, and in being rational or irrational intervals. Intervals differ in size in that some intervals are larger, some smaller, for example, the ditone, whole tone, halftone, dia tessaron, dia pente, dia pason, and the like. [9.10] Intervals differ by genus in that some intervals are diatonic, some chromatic, and some enharmonic. [9.12] Intervals differ in consonance in that some intervals are consonant, some dissonant. Examples of consonant intervals are the dia tessaron, dia pente, dia pason, and so forth. Dissonant intervals are all those intervals which are smaller than the dia tessaron and all those between the consonances. Smaller than the dia tessaron are the quartertone, halftone, whole tone, and ditone; between the consonances are the tritone, tetratone, pentatone, and so forth. A consonance is the blending of two higher and lower notes. Dissonance is the opposite, the compatibility of two notes which cannot be blended but instead grate roughly on one's hearing.

10.3 Intervals differ in compositeness in that some intervals are non-composite, some composite. Non-composite intervals are those intervals bounded by consecutive notes, for example, by hypate and parhypate, and by lichanos and mese. The same principle applies to the remaining intervals as well. Composite intervals are those bounded by non-consecutive notes, for example, by mese and parhypate, by mese and nete, and by paramese and hypate. There are certain intervals common to the composite and non-composite: [10.10] those from the halftone to the ditone, for the halftone interval is composite in the enharmonic genus, but non-composite in the chromatic and diatonic; the whole tone is composite in the chromatic, but non-composite in the diatonic; the

the trihemitone is non-composite in the chromatic, composite in the diatonic; the ditone is non-composite in the enharmonic, composite in the chromatic and diatonic. Those intervals smaller than the halftone interval are all non-composite, and similarly, those greater than the ditone are all composite.

11.2 The difference between rational and irrational intervals lies in that some intervals are rational and some irrational. Ratinal intervals are those whose size it is possible to calculate, for example, the whole tone, halftone, ditone, tritone, and so forth. Irrational intervals are those intervals which vary these sizes by increasing or decreasing them by some irrational amount.

11.9 The genera are the three already mentioned. Every melody is either diatonic or chromatic or enharmonic or common or a mixture of these. The diatonic genus is that which employs the diatonic division, the chromatic genus that which employs the chromatic division, the enharmonic genus that which employs the enharmonic division. A common melody is that which is composed from the fixed notes. The melody of mixed genus is that in which two or three generic characteristics appear, for example, the diatonic and chromatic, or the diatonic and enharmonic, or the chromatic and enharmonic, or the diatonic, chromatic, and enharmonic. [11.18] Differences between genera exist among the movable notes. The lichanos moves within the locus of a whole tone, the parhypate within the locus of a quartertone. The highest lichanos is that lying a whole tone away from the higher note bounding the tetrachord; the lowest lichanos is that lying a ditone away from the higher note bounding the tetrachord. Similarly, the lowest parhypate is that lying a quartertone away from the lowest note bounding the tetrachord;

the highest that lying a half tone away.

12.6 A shade is a particular division of a genus. Six shades are mentioned and acknowledged--one in the enharmonic genus, three in the chromatic and two in the diatonic. The shade of the enharmonic genus employs the same division as the genus, for it is constructed by quartertone plus an equivalent quartertone plus ditone. [12.12] The lowest shade of the chromatic divisions is the soft chromatic; it is constructed with a third-tone plus an equivalent third-tone plus an interval equal to a whole tone plus halftone plus third-tone. The hemiolic chromatic is constructed with a diesis one and one-half times the size of the quartertone and a equivalent diesis and a non-composite interval of seven quartertone dieses. The tonic chromatic employs the same shade as the genus, for it is constructed with halftone plus halftone plus trihemitone. The aforementioned chromatic shades derive their names from the pykna present within them, [13.7] for the "tonic" chromatic derives its name from the composite tone present within it; the "hemiolic" chromatic from the dieses within in, which are one and one-half times the size of the enharmonic quartertone; the "soft" chromatic similarly is the chromatic having the smallest pyknon since the pyknon within it is both loosened and relaxed.

14.5 Of the diatonic divisions there are the soft diatonic and the syntonic diatonic. The soft diatonic shade is constructed with a halftone plus a non-composite interval of three quartertones plus a similarly non-composite interval of five quartertones. The syntonic diatonic shade shares the same division as the genus, for it is constructed with a halftone plys whole tone plus whole tone.

14.12 The shades are demonstrated also through numbers by the fol-

lowing method, for the whole tone is assumed to be divided into some twelve smallest parts of which each part is called one-twelfth of a whole tone. The remaining intervals are calculated in proportion to the tone, for the halftone is divided into six twelfths, the quarter-tone diesis into three twelfths, the third-tone diesis into four twelfths, and the entire dia tessaron into thirty twelfths. The enharmonic genus will be constructed by three (twelfths) plus three plus twenty-four; the soft chromatic by four plus four plus twenty-two; the hemiolic chromatic by four and one-half plus four and one-half plus twenty-one; the tonic chromatic by six plus six plus eighteen; the soft diatonic by six plus nine plus fifteen; the syntonic diatonic by six plus twelve plus twelve.

15.3 Systems differ in seven ways; four of these differences are the same as the differences in intervals—difference by size and by genus and by being consonant and dissonant and by being rational and irrational. Three of the differences are particular to systems--the differences between consecutive and non-consecutive systems, that between conjunct and disjunct systems, and that between non-modulating and modulating systems. [15.9] By size the larger systems differ from the smaller just as the dia pason differs from the tritone or the dia pente or the dia tessaron or the like. [15.12] By genus the diatonic systems differ from the enharmonic or chromatic systems, or the chromatic or enharmonic systems differ from the rest. [15.14] By consonance and dissonance the systems bounded by the notes which form consonances will differ from those bounded by notes which form dissonances. There are six consonances in the non-modulating system. The smallest is the dia tessaron, consisting of two and one-half whole tones, for

example, the system from hypate hypaton to hypate meson. Second, the dia pente, consisting of three and one-half whole tones, for example, that from proslambanomenos to hypate meson. Third, the dia pason, consisting of six whole tones, for example, that from proslambanomenos to mese. Fourth, the dia pason plus dia tessaron, consisting of eight and one-half whole tones, for example, that from proslambanomenos to nete synemmenon or to diatonic paranete diezeugmenon. Fifth, the dia pason plus dia pente, consisting of nine and one-half whole tones, for example, that from proslambanomenos to nete diezeugmenon. Sixth, the double dia pason, consisting of twelve whole tones, for example, that from proslambanomenos to nete hyperbolaion. [16.16] The conjunct system proceeds up to the fourth consonance, for first in it is the dia tessaron, second the dia pente, third the dia pason, and fourth the dia pason plus dia tessaron. [16.20] The compass of the voice is increased up to the eighth consonance which means the double dia pason plus dia tessaron and the double dia pason plus dia pente. Dissonant systems are both all those systems smaller than the dia tessaron and all those systems between the aforementioned consonant systems.

17.4 Systems also have figures of the same size which are composed from the same non-composite intervals and from the same number of intervals, if their arrangement takes on some variations with some internal property being dissimilar; for those systems which are composed of entirely equal or similar figures have no variation. [17.8] There are three figures of the dia tessaron: First, that bounded by barypyknoi, for example, that from hypate hypaton to hypate meson; second, that bounded by mesopyknoi, for example, that from parhypate hypaton to parhypate meson; third, that bounded by oxypyknoi, for

example, that from lichanos hypaton to lichanos meson. [17.15] In the enharmonic and chromatic genera the figures of the consonances are calculated by the arrangement of the pyknon, but in the diatonic genus figures do not depend on the pyknon arrangement; this genus is divided into halftones and whole tones. In the dia tessaron consonances there is one halftone and two whole tones, and similarly, in the dia pente there is one halftone and three whole tones; in the dia pason there are two halftones and five whole tones. The figures are reckoned by the arrangement of the halftones. [18.3] In this way the first figure of the dia tessaron is that whose halftone lies beneath the whole tones. The second figure is that whose halftone lies between the whole tones. These figures are also similar to those in the other genera, ranging from the same notes to the same notes.

18.9 There are four figures of the dia pente. First is that bounded by barypyknoi and whose whole tone is the highest interval; it can be found from hypate meson to paramese. Second is that bounded by mesopyknoi and whose whole tone is the second highest interval; it can be found from parhypate meson to trite diezeugmenon. Third is that bounded by oxypyknoi and whose whole tone is the third highest interval; it can be found from lichanos meson to paranete diezeugmenon. Fourth is that bounded by barypyknoi and whose whole tone is the fourth highest interval; it can be found from mese to nete diezeugmenon or from proslambanomenos to hypate meson. [18.20] In the diatonic genus the first figure is that whose halftone appears as the lowest interval. The second figure is that whose halftone appears as the highest interval. The third figure is that whose halftone appears as the second highest interval. The fourth figure is that whose halftone appears as

the third highest interval.

19.4 There are seven figures of the dia pason. The first is that bounded by barypyknoi and whose whole tone is the highest interval; it is found from hypate hypaton to paramese, and it was called "Mixolydian" by the ancients. The second figure is that bounded by mesopyknoi and whose whole tone is the second highest interval; it is found from parhypate hypaton to trite diezeugmenon and was called "Lydian." The third figure is that bounded by oxypyknoi and whose whole tone is the third highest interval; it is found from lichanos hypaton to paranete diezeugmenon and was called "Phrygian." The fourth figure is that bounded by barypyknoi and whose whole tone is the fourth highest interval; it is found from hypate meson to nete diezeugmenon and was called "Dorian." The fifth figure is that bounded by mesopyknoi and whose whole tone is the fifth highest interval; it is found from parhypate meson to trite hyperbolaion and was called "Hypolydian." The sixth figure is that bounded by oxypyknoi and whose whole tone is the sixth highest interval; it is found from lichanos meson to paranete hyperbolaion and was called "Hypophrygian." [20.10] The seventh figure is that bounded by barypyknoi and whose whole tone is the lowest interval; it is found from mese to nete hyperbolaion or from proslambanomenos to mese and was called "Common" and "Locrian" and "Hypodorian."

20.14 In the diatonic genus the first figure of the dia pason is that whose one halftone is the lowest interval and whose other halftone is the fourth highest interval. The second figure is that whose one halftone is the third lowest interval and whose other halftone is the highest interval. The third figure is that both of whose halftones

are the second interval from each end. The fourth figure is that whose one halftone is the lowest interval and whose other halftone is the third highest interval. The fifth figure is that whose one halftone is the fourth lowest interval and whose other halftone is the highest interval. The sixth figure is that whose one halftone is the third lowest and whose other halftone is the second highest interval. The seventh figure is that whose one halftone is the second lowest and whose other halftone is the third highest interval. These diatonic figures range from the same notes to the same notes as the enharmonic and chromatic figures, and they are called by the same names.

21.4 Systems will differ by the difference between rational and irrational systems in that those systems which are composed of rational intervals differ from those composed of irrational intervals; rational systems are composed of rational intervals, and irrational systems are composed of irrational intervals.

21.8 In the difference between consecutive and non-consecutive systems, the system constructed with consecutive notes will differ from those constructed with non-consecutive notes.

21.11 In the difference between conjunct and disjunct systems, systems which have their construction by conjunct tetrachords will differ from those which have their construction by disjunct tetrachords. A conjunction is the note common to two juxtaposed tetrachords of similar figure. A disjunction is the whole tone between two juxtaposed tetrachords of similar figure. There are three conjunctions in all--lowest, middle, and highest. The lowest conjunction is that between the hypaton and meson tetrachords; a common note joins them, hypate meson. The middle conjunction is that between the meson and neton

synemmenon tetrachords; a common note joins them, mese. The highest conjunction is that between the diezeugmenon and hyperbolaion tetrachords; a common note joins them, nete diezeugmenon. There is one disjunction between the meson and neton diezeugmenon tetrachord; a common whole tone disjoins them, that between mese and paramese.

22.10 There are two perfect systems, the lesser and the greater. The lesser system is a conjunct system ranging from proslambanomenos to nete synemmenon. These are the three conjunct tetrachords in the lesser system--hypaton, meson, and synemmenon--and one whole tone from proslambanomenos to hypate hypaton. The lesser system is delimited by the dia pason plus dia tessaron consonance. [22.17] The greater system is a disjunct system ranging from proslambanomenos to nete hyperbolaion. There are four tetrachords in the greater system disjoined into two pairs which are each conjunct--the hypaton and meson, and diezeugmenon and hyperbolaion; and there are also two whole tones, one from proslambanomenos to hypate hypaton and the other from paramese to mese. The greater system is delimited by the double dia pason. [23.8] There are five tetrachords in the non-modulating system, which is composed of both perfect systems; two of the tetrachords belong to both perfect systems--both the hypaton and meson tetrachords. Particular to the conjunct system is the neton synemmenon tetrachord, and particular to the disjunct system are the neton diezeugmenon and neton hyperbolaion tetrachords.

23.14 Systems will differ by being non-modulating or modulating in that simple systems differ from those that are not simple. Simple systems are those constructed with one mese; duple systems are those constructed of two mesai; triple are those constructed with three mesai,

and multiple systems are those constructed with more mesai. A mese has the function of a note which, in the disjunct system, has a non-composite whole tone above it and a ditone, either composite or non-composite, below it; the system meanwhile remains the same. In the conjunct system where there are three conjunct tetrachords, mese has the function of a note which is either the highest note of the middle tetrachord or the lowest note of the highest tetrachord. [24.3] The functions of the remaining notes are also recognized from the mese, for the function of each note becomes clear with respect to mese.

24.6 Tone is spoken of in four ways--as a note and interval and as a region of the voice and as a tuning. Those who speak of the seven-toned phorminx, such as RTerpander and Ion, use the word as a type of "note." Terpander says:

> "We who despise the four-voiced song
> Will cry aloud for you new hymns with the seven-toned
> phorminx."

and Ion says:

> "Eleven-stringed lyre with the ten-interval arrangement
> For the three consonant roads of harmony,
> Once all Hellenes plucked you, seven-toned twice four,
> Raising up a meager Muse.

and many others use this meaning of "tone." [25.1] "Tone" is used as an interval when we say that there is a "tone" from mese to paramese.

25.4 "Tone" is used as a region of the voice when we say that there is a Dorian "tone" or Phrygian "tone" or Lydian "tone" or some other "tone." According to Aristoxenus, there are thirteen: Hypermixolydian, also called "Hyperphrygian"; two Mixolydians, a higher

and a lower, of which the higher is also called "Hyperionian," and the lower "Hyperdorian"; two Lydians, a higher and lower, of which the lower is also called "Aeolian"; two Phrygians, a higher and lower, of which the lower is also called "Ionian"; one Dorian; two Hypolydians, a higher and a lower, of which the lower is also called "Hypoaeolian"; two Hypophrygians, of which the lower is also called "Hypoionian; Hypodorian. [26.9] The lowest of these tones is the Hypodorian, with each successive tone from the highest to the lowest surpassing its predecessor by a halftone, and two parallel tones by a (tri) hemitone. [26.13] The distance between the remaining tones can be calculated by the same method, the Hypermixolydian being one dia pason higher than the Hypodorian.

26.16 That "tone" which means a tuning is used when we speak of someone "singing a high tone" or "singing a low tone" or "singing in the middle tone of his range."

26.19 Modulation is spoken of in four ways—modulation by genus, by system, by tone, and by melodic composition. Modulation by genus occurs when there is a modulation from the diatonic genus into the chromatic or enharmonic genus, or from the chromatic or enharmonic genus into one of the other genera. [27.5] Modulation by system occurs when there is a modulation from the conjunct system into the disjunct system system or <u>vice versa</u>. Modulation by tone occurs when there is a modulation from the Dorian into the Phrygian, or from the Phrygian into the Lydian or into the Hypermixolydian or into the Hypodorian or generally from any one of the thirteen tones into one of the other twelve. [27.10] Beginning with a modulation by halftone, modulations occur up to a dia pason; some of these modulations take

place through consonant intervals, others through dissonant intervals. Of these modulations, both those which take place through consonant intervals as well as the modulation by a whole tone are melodic. Of the remaining modulations some are less un-melodic, others more. The more there is in common in a modulation, the more melodic it will be, for in every modulation it is necessary that there be some note or interval or system in common. Being in common is reckoned according to the similarity of notes, for when similar notes concur in modulations so as to concur in the pyknon, the modulation is melodic, but when dissimilar notes concur, the modulation is unmelodic.

28.3 Modulation by melodic composition occurs when there is a modulation from the diastaltic ethos into the systaltic or hesychastic, or from the hesychastic into one of the other ethe. The diastaltic ethos of melodic composition is that through which magnificence, the manly elevation of the soul. heroic deeds, and such properties of the soul are indicated. Tragedy especially employs those properties as does any other genre of this character. The systaltic ethos is that through which the soul is directed toward dejection and an unmanly condition. Such a state agrees with amorous feelings, lamentations, wailings, and the like. The hesychastic ethos of melodic composition is that which peace of the soul and a leisurely and peaceful condition accompany. Hymns, paeans, encomia, advisories, and the like correspond to this ethos.

28.19 Melodic compostion is the employment of the aforementioned harmonic parts and of its established properties which have some function. Melodic composition is accomplished through four methods: succession, weaving, repetition, and prolongation. Succession is a

melodic progression through consecutive notes. Weaving is the non-consecutive and parallel placement of intervals. Repetition is the playing of one tone again and again. Prolongation is the holding of one utterance of the voice fora greater amount of time.

29.8 [A diagram is a two-dimensional chart which shows the functions of harmonic constructions.

29.10 Function is the positioning of a note in a system, or, function is the positioning of a note by which we recognize each of the notes.

Melodic composition is the employment of the properties of harmonic practice with regard to what is proper for each subject.]

29.16 This is the limit of the study of harmony.

COMMENTARY

ATTRIBUTION OF THE Εἰσαγωγὴ ἁρμονική:

Attributing the treatise to Cleonides depends equally on paleographical, musicological, grammatical, and historical evidence. Only one of the better manuscripts, C, carries the name Κλεονείδου,[1] and the rest of the manuscript tradition suffers from a variegated confusion of the author's name. By the twelfth-century Byzantine revival of interest in ancient Greek musicology, the name of the author of the Εἰσαγωγὴ ἁρμονική was already a confused issue. Of the twelfth or thirteenth-century manuscripts, M omits attribution while M^1 later attributes the treatise to Euclid (whence the Euclidean attributions in U and its descendants, apparently): C and P atrributed the treatise to Cleonides and to Pappus, respectively. The fourteenth-century Z attributes the treatise to a certain Zosimus, and several descendants of Q attribute the treatise without conviction to "Anonymous." Z and Q represent a later branch of the tradition descended from MM^1CP, and so their testimony can be eliminated for the present. Of the several attributions to Euclid, Cleonides, and Pappus by M^1, C, and P, it is the attribution to the great geometrician Euclid which has caused a heated debate.

Euclidean authorship for the Εἰσαγωγὴ ἁρμονική was recognized certainly no later than the tenth century, for the evidence is compelling that Arabic (and Persian) musicologists associated this treatise with the Euclidean corpus. In such matters one is necessarily at the mercy of other scholars familiar with another culture's

language and methodology, but Henry George Farmer, as intercessor, seems to present incontrovertible evidence.[2] The Fihrist and Ibn al-Qifti knew of two musical works connected with Euclid's name, a Kitâb al-qânûn and a Kitâb al-hagham. The former title, of course, must refer to an Arabic version of the Sectio Canonis, for the very word κανόνος ("al-qânûn") is preserved in the Arabic title. The latter, therefore, should refer to the Εἰσαγωγὴ ἁρμονική, and the word "al-nagham" is a reasonably accurate Arabic translation of ἁρμονική, a concept somewhat foreign to Arabic music. Further evidence is found in the works of Ibn al-Haitham (d. 1038), for he wrote two musical works, a Sharh ("Commentary") al-qânûn and a Sharh al-rumûniqi. The former is again undoubtedly the Sectio Canonis in Arabic, for Ibn al-Qifti (168) lists the work as belonging to Euclid (Uqlaidis);[3] the latter seems to contain a paleographical error--"al-rumûniqi" for "al-armûniqi" (=ἁρμονική).[4]

Arab musicologists not only had access to the Εἰσαγωγὴ ἁρμονική, they alertly found the Euclidean attribution to be suspect. They pointed out the obvious mathematical, musicological discrepancy between Euclidean (Pythagorean) thought presented in the Euclidean Sectio Canonis, and the (Aristoxenian) thought presented in the Εἰσαγωγὴ ἁρμονική.[5] Jan (169) described this discrepancy most succintly: "Diapason comprehendere minus sex tonos affirmat Euclides pr. 14 [Jan 160], sex tonorum esse ait hic auctor cap. 8 [16.7f]." That is, the Euclid who authored the Sectio Canonis states quite axiomatically that the dia pason, i.e. octave, consists of less than six tones;[6] since the size of the whole tone was one of the essential discrepancies between Pythaogrean and Aristoxenian schools of musicology, it would

be virtually impossible for the same mathematician to have written both the Sectio Canonis and the Εἰσαγωγὴ ἁρμονική. According to the musicology of the author of the Sectio Canonis (pr. 9), "τὰ ἔξ ἐπόγδοα διαστήματα μείζονά ἐστι διαστήματος ἑνὸς διπλασίου" and (pr. 14), "τὸ διὰ πασῶν ἔλαττον ἢ ἔξ τόνων." This same mathematical axiom is found in Nicomachus, Boethius, and Ptolemy. The Pythagoreans, to elaborate, concentrated their "musical" studies on numerical relationships. The dia pason (octave) they described by the proportion 3:2 (ἡμιόλιον), the dia tessaron (fourth) by the proportion 4:3 (ἐπίτριτος). The whole tone they described as the difference between the dia pente and dia tessaron (3:2 ÷ 4:3), that is 9:8 (ἐπόγδοος). This 9:8 proportion was superparticular, and according to pr. 3 of the Sectio Canonis stated above, this proportion cannot have a mean. For the Pythagoreans, therefore, there was no rational note called "ἡμιτόνιον." The arithmetical mean of 9:8 is irrational (ἄλογος, $3:2\sqrt{2}$), and not a note at all for those who would express the entire universe in terms of integers. This method of numerical, proportional analysis cannot be found in the Εισαγωγὴ ἁρμονική or in Aristoxenian musicology in general, and yet it pervades Pythagorean (and Euclidean) thought.

The Islamic scholars also pointed out that Euclid never used the dual voice, and yet the dual could be found in the Εἰσαγωγὴ ἁρμονική(3.6).[7] The first Western scholar to question an Euclidean attribution for the treatise was the father of Hugo Grotius who wrote a commentary on Martianus Capella.[8] The elder Grotius based his suspicions on the rationality of half tones in the Εἰσαγωγὴ ἁρμονική, an impossibility in Euclidean theory.

In 1662 Marcus Meibom was the first to advance reasons for

accepting the Euclidean attribution. The Εἰσαγωγὴ ἁρμονική is such a marvelous treatise, suggests Meibom, that even if the manuscripts did not say that Euclid wrote it, he would be able to deduce immediately that he did.[9] Meibom also makes mention of Valla's editio princeps (1497) and points out that Valla attributed the treatise to Cleonides only because he used the single manuscript Neapolitanus gr. 260 [f. 55^{r}- 63^{v}, 19, a descendant of C] which itself attributed the treatise to Cleonides. Lastly, Meibom condemns the various author attributions of Possevinus (to Pappus) and of Vulcanius (to "Anonymous") as poor editorial work (ex scriptorum vitio). It is this argument by Meibom that Jan (169) attacks in the introduction to his text of the treatise; Jan's argument has already been reviewed. There may be one other problem involved here, however, for there are those who doubt that Euclid wrote the Sectio Canonis; if this were true, the arguement advanced by the Arab scholars and Jan--that Euclid could not have written both the Εἰσαγωγὴ ἁρμοινική and the Sectio Canonis--would become irrelevant. For this theory, see infra, Appendix 1.

Pappus (Alexandrinus) is given credit for writing the treatise by the scribe of P.[10] Pappus, who flourished in the early fourth century A.D., is generally recognized as the last great mathematician of antiquity.[11] His works include the following: A Commentary on Euclid's Elements which is briefly quoted by Proclus and which is otherwise lost except for book 10 which survives in Arabic; a commentary on Ptolemy's Almagest of which books 5 and 6 are extant; and lost commentaries on Euclid's Data (Δεδόμενα) mentioned in Marinus' commentary on the same, on Ptolemy's Planisphaerium translated into Arabic by Thābit ben Qurra, and on Diodorus' (first century B.C.)

Ἀνάλημμα. He also wrote a universal geography (χωρογραφία οἰκουμενική) based upon Ptolemy's map of the world, and his well-known Collection (Συναγωγή), a handbook of Greek science. The extant passages--Books 3-8 and parts of book 2--offer essays on geometry, astronomy, optics, and mechanics. He may also have written a commentary to Ptolemy's extant treatise on harmonics, this being the opinion of, among others, Lucas Hostenius.[12]

In addition to the lack of ancient testimony for a "de musica" by Pappus, this Pappus could not have written the Εἰσαγωγὴ ἁρμονική because of his association with other Pythagorean mathematicians; his commentaries on the works of Euclid and Ptolemy refute the manuscript attributions in our Aristoxenian treatise. Especially if he had written a commentary on Ptolemy's Harmonics, Pappus would have defined a dia pason as consisting of less than six tones, not of the six tones which this "Cleonides" and the other Aristoxenians postulate.[13]

Two manuscripts, Matritensis 4678 (Z) and Vaticanus Ottobonianus 372, attribute the treatise to Zosimus, but about this Zosimus we are unfortunately not so knowledgeable as we are about Pappus and Euclid. Ten men named Zosimus are known to us from antiquity: A first-century B.C. Thasian writer of epigrams; a freedman of the younger Pliny; an engraver who specialized in caelatura Clodiana; the teacher (τροφεύς) of Aelius Aristeides the rhetorician; a physician of unknown date who is mentioned in Galen 12.753.12f.; an official (praeses Epiri novae) during the reigns of Valentinian and Valens (found in Edict. Cod. Theod. VI.31 and XII.10); the sophist and grammarian from Ascalon who flourished in the late fifth century A.D.; the well-known historian of c. 500 A.D.; the pope who reigned briefly in 417-418; and

the third or fourth-century A.D. alchemist from Egyptian Panopolis.[14] None of these ten men named Zosimus seem likely candidates for the authorship of the Εἰσαγωγὴ ἁρμονική. No mathematician or musician named "Zosimus" is cited in any ancient source, and so we know absolutely nothing about this particular Zosimus, if he was indeed an ancient mathematician or musicologist. Although unlikely, it is possible that at some point in the tradition of the treatise it became associated with the corpus of a Zosimus--perhaps the alchemist, and there is still one other possibility. On folio 16 of M (47) is the brief note, "Ζώσιμος διώρθου ἐν Κωνσταντινουπόλει εὐτυχῶς." The διώρθου, of course, refers to the fact that this Zosimus corrected the codex, (M^1?), but Fabricius, Marquard, and Westphal all thought that this Zosimus had originally copied the codex. On the other hand, it is tempting to trace the Zosimus of the Εἰσαγωγὴ ἁρμονική in Z to this scribe; perhaps the scribe of Z mistakenly thought that Zosimus was the author of the treatise, as Jan (170-71) suggested. In support of Jan's theory I will add that if Z or its archetype copied M directly, it did so by the fourteenth century; it is possible, therefore, that at this time the treatise carried no author attribution with it, for it is M^1 which attributed the treatise to Euclid. When this scribe then saw this name, Zosimus, on folio 16, he incorrectly added this name to the Εἰσαγωγὴ ἁρμονική. On the other hand, I cannot believe that this is how Zosimus' name became associated with the treatise. Although the name Zosimus certainly does appear on folio 16 of M, folio 16 contains the end of the Sectio Canonis and not the beginning or end of the Εἰσαγωγὴ ἁρμονική. The location of this name would in all likelihood have suggested to a scribe that

both the Sectio Canonis and the Εἰσαγωγὴ ἁρμονική were written by this Zosimus, or at least the Sectio Canonis. But Matritensis 4678 attributes the Εἰσαγωγὴ ἁρμονική to Zosimus and the Sectio Canonis to Euclid.[15] If Jan's theory were correct, one would expect the Εἰσαγωγὴ ἁρμονική to have been attributed to Euclid and the Sectio Canonis to Zosimus. Perhaps the scribe of Z or its archetype was desperately grasping at any name he could find? On the other hand, Zosimus was a popular name both in antiquity and in the Byzantine era, so it is not impossible that there could have been a musicological author named Zosimus about whom we know nothing even if there are almost a dozen Zosimus' about whom we do know something. But since the name Zosimus has no known association with a musicologist, and since Z represents an inferior part of the manuscript tradition, there will hardly be any compelling reason for attributing the work to him rather than to Cleonides.

Unfortunately, we have no testimonia about a musicological writer named Cleonides, and the treatise reveals only his musicology, not his century or provenance. Abert ("Kleonides" RE XI 729) stated that Cleonides lived in the second century A.D., but he offers no citation or evidence for this information. Later encyclopedic entries follow Abert in dating Cleonides to the second century A.D.[16] Ruelle (10) in his translation of the treatise tried to propose a terminus ante quem for Cleonides: Because Aristides Quintilianus, a contemporary of Plutarch, mentions fifteen tones and Cleonides only thirteen, Ruelle reasons, Cleonides must predate Aristides, the earliest writer to list fifteen tones. Strunk (34) in his English translation of the treatise derives the opposite opinion from the same information.

Strunk suggests that Cleonides was trying to restore Aristoxenus' original thirteen tones in answer to the fifteen listed in Aristides, and so Cleonides must postdate Aristides and perhpas also another expositor of the fifteen tones--Alypius. Neither argument is convincing for they use similar logic and the same information to derive exactly opposite conclusions. There is no other way to date precisely either Cleonides or the treatise except to establish an obvious terminus post quem in Arsitoxenus. Not only does "Cleonides" summarize and unify Aristoxenus' musicological theories, but he also mentions Aristoxenus when citing the thirteen tones (25.6). No other proper names appear in the treatise other than Ion and Terpander, both of whom Cleonides most clearly postdates.[17]

Because the treatise consists entirely of technical terminology found in all musicologists from Aristoxenus to Alypius to Bryennius, it is also impossible to date the treatise stylistically. One bit of evidence for a terminus post quem is the lack of any treatise entitled Εἰσαγωγή before Geminus in the first century B.C., but besides the weakness inherent in any argumentum ex silentio, it must also be remembered that MCP of the twelfth century omit the title of the treatise. On the other hand, a terminus post quem of the first century B.C. would not present any chronological difficulties.[18]

I have chosen to attribute the Εἰσαγωγὴ ἁρμονική to Cleonides, for. whether or not the Sectio Canonis is in fact by Euclid, it is nonetheless Euclidean in that it is Pythagorean. In this case, the Aristoxenian Εἰσαγωγὴ ἁρμονική cannot belong to Euclid or to the Pythagorean and Euclidean Pappus. Zosimus is cited as the author of this treatise in only two inferior manuscripts. This leaves only

Cleonides or Anonymous, and the former can be described as simply the *difficilior lectio*. Ultimately, however, there is only a small difference between an attribution to Cleonides and an attribution to Anonymous.

NOTES

1
Florentinus Riccardianus gr. 41 (f. 68^{r}f) and Parisinus gr. 2535 spell the name Κλεονίδου.

2
Henry George Farmer, "Greek Theorists of Music in Arabic Translation," Isis 13 (1930) 327f., gleans his information from two compendia, the Fihrist [of Ibn-al-Nadim, c. 978 A.D.] and [the epitome (by al-Zawani (1249 A.D.)) of the Ta'rikh al-hukama of] Ibn al-Qifti [b. 1172].

3
Ibn al-Qifti, however, could posdate the M^{1} corrections in the Greek tradition of the texts.

4
The simple transliteration (rather than translation) of Greek technical terms occurs frequently in Arabic, e.gg. "al-mûsîqî" and "qanun." Cf. H. J. Mason, Greek Terms for Roman Institutions: A Lexicon and Analysis (Toronto 1974).

There is some possibility that the renowned work of Al-Farabi, the Kitâb al-mûsîqî al-kabîr, shows some reliance on the Εἰσαγωγὴ ἁρμονική; Farmer (see supra, n. 2, 330) doubts that Al-Farabi borrows from Aristides Quintilianus; they differ in the order in which they present their terms and definitions. Perhaps Al-Farabi's unknown source was our treatise. I leave the matter at this, for it lays beyond the scope of this present work; cf. infra, comm. 14.12.

5
See J. L. Heiberg, Litterargeschichtliche Studien über Euklid (Leipzig 1882) 9, but Heiberg does not specify which Arabic sources he used. Here he mentions only Hassan ben Haithem [=Ibn al-Haitham], for whom he cites L. AM. Sédillot, "Du Traité des connues géométriques de Hassan ben Haithem, intitule," Journal asiatique^{2} 13 (1834) 438f., but this article regards only the Euclidean Πορίσματα. Elsewhere (p. 1) Heiberg acknowledges Hadji Khalfa--the seventeenth-century Ottoman polyhistor, Abdulpharaji--the thirteenth-century Syriac and Arabic historian, and Casiri. Again, the vast problem of establishing, and reading these encyclopedic Arabic sources is beyond the scope of the present work. One may begin, however, with J. H. Mordtmann, "Ḥādjdjī Khalīfa," The Encyclopedia of Islam II 204-206, and J. B. Segal, "Ibn al-Ibri," The Encyclopedia of Islam^{2} III (1971) 804-805.

6
One whole tone can be described by the superparticular proportion 9:8, and the sum of six of these proportions (6 x 9/8 = 54/8) is greater than the dia pason of six tones (= 6).

7
See H. Schmidt, "De Duali Graecorum emoriente et revivescente," Breslauer Philologishe Abhandlungen 6 (Breslau 1893) 18-20, and Franz Susemihl, Geschichte der griechischen Litteratur in der Alexandrinerzeit I (Leipzig 1891) 717, n. 59. Jan (177) deleted the dual.

If in fact the treatise was attributed to Euclid in the middle ages, M^1 (and U) could not have been the original source(s) of this attribution; the question then arises, what happended to the Euclidean attribution between the Islamic middle ages and the corrections of M^1? Was the prototype for M^1 dervied from an Arabic manuscript? Or was the Arabic part of the tradition subsumed by our γ and thence to MCP?

8
Hugo Grotius (de Groot), (Leiden 1599) 316, to be found in Ulrich F. Kopp, Martiani Capellae De Nuptiis Philologiae Mercuri... libri novem (Frankfurt 1836) 727. The scholar cites his father's theory; the younger Grotius wrote this commentary at the age of fifteen.

9
Meibom 2: "Illae autem auctoris huius virtutes adeo etiam in hoc opusculo sunt conspicue, ut si vel nomen ipsum in nullo codice praefixum legeretur, inde agnosci posset."

10
This attribution is maintained by the editor who read only a P-type manuscript, Possevinus (1603).

11
Konrat Ziegler, "Pappus," RE XVIII/3 355-56.

12
"De vita et scriptis Porphyrii VII," in Johann Albert Fabricius, Bibliotheca graeca IV 251 (Hamburg 1704-1728). They believe the Harmonics was actually written by Pappus, for the title of a Vatican manuscript (which is not specified) begins with the words, Πορφυρίου ἐξήγησις εἰς δ' πρῶτα κεφάλαια τοῦ πρώτου τῶν ἁρμονικῶν Πτολεμαίου, and then continues with Πάππου ὑπόμνημα εἰς τὰ ἀπὸ τοῦ ε κεφαλαίου ἑφεξῆς. Fabricius adds, "Pappi de Musica codicem Vaticanum his tribus verbis breviter citat [Bernard de] Montfaucon, Bibliotheca [Bibliothecarum] manuscriptorum [nova], I [(Paris 1739?)] p. 11 B," which would be codex 41. See also F. Hultsch, ed., Pappi Alexandri Collectionis quae supersunt III (Berlin 1878) xii; Charles-Émile Ruelle, "Études sur l'ancienne musique grecque," Extrait des Archives de missions scientifiques et littéraires[3] 2 (1875) 512; and see Ziegler (supra, n. 11).

13

For more on Pappus, see Ziegler, (supra, n. 11) 1084-1106; M. Cantor, Vorlesungen über Geschichte der Mathematik^3 I (Leipzig 1907) 441-55; Edmund Hoppe, Mathematik und Astronomie im Klassischen Altertum (Heidelberg 1911) 410-19; Heath, History II 355-439; J. L. Heiberg, Geschichte der Mathematik und Naturwissenschaften in Altertum (Munich 1925) 42f.; G. Loria, Histoire des sciences mathématiques dans l'antiquité hellénique (Paris 1929) 99-108; and the editions of William Thomson and Gustav Junge, The Commentary of Pappus on Book X of Euclid's Elements (Cambridge (Mass.) 1930) and Hultsch, Pappi I-III (Berlin 1876-78).

14

For the first nine men named Zosimus, see "Zosimus" in RE X/A 786-844; for the alchemist see Riess, "Alchemie" RE I 1345-49.

15

Vaticanus Ottobonianus gr. 372 also attributes the treatise to Zosimus, but it does not even contain the Sectio Canonis. Vaticanus gr. 191 (29) is another descendant of Z (possibly even predating Matritensis 4678) but it does not even mention Zosimus.

16

E.gg. Winnington-Ingram, "Greek Music" OCD^2 706; G. Wille, "Kleoneides" Lexicon der alten Welt 1548; and Solon Michaeliedes, The Music of Ancient Greece; an Encyclopedia (London 1978) ad loc.

17

We almost have a terminus ante quem in Porphyry's Commentary to Ptolemy's Harmonics. At 86.8f. Porphyry discusses the Aristoxenian definition of φθόγγος: Παρὰ δὲ τοῖς Ἀριστοξενείοις· φθόγγος ἐστὶ φωνῆς ἐμμελοῦς πτῶσις ἐπὶ μίαν τάσιν. ἡ ἐμμελῆς οὖν φωνῆς πτῶσις ἐπὶ μίαν τάσιν. The latter definition parallels that of the Εἰσαγωγὴ ἁρμονική(1.9). Did Porphyry have access to the Εἰσαγωγὴ ἁρμονική? The other extant Aristoxenians have the following definitions of φθόγγος: Bacchius (4)--φωνῆς ἐμμελοῦς πτῶσις ἐπὶ μίαν τάσιν, Gaudentius (2): φθόγγος δέ ἐστι φωνῆς πτῶσις ἐπὶ μίαν τάσιν, Bryennius (88.15f.): ἡ φθόγγος ἐστὶ φωνῆς πτῶσις ἐμμελῆς ἐπὶ μίαν τάσιν ἤτοι φωνῆς διαστηματικῆς, and Aristoxenus himself (20.16f.): συντόμως μὲν οὖν εἰπεῖν φωνῆς πτῶσις ἐπὶ μίαν τάσιν ὁ φθόγγος ἐστί. The first part of Porphyry's definition is paralleled in Bacchius, the second in the Εἰσαγωγὴ ἁρμονική (φθόγγος μὲν οὖν ἐστι φωνῆς πτῶσις ἐμμελῆς ἐπὶ μίαν τάσιν). Gaudentius' definition most closely resembles Aristoxenus', for both omit the term ἐμμελῆς/-οῦς. Bryennius, as he often shows, had access to Cleonides. Cleonides and Bacchius seem to have been used by Porphyry, but while one would like to say that Porphyry had access to Cleonides and thereby propose a terminus ante quem of c. 275 A.D. for the Εἰσαγωγὴ ἁρμονική, he must first realize that Bacchius certainly postdates Porphyry. Bacchius' treatise begins (Jan 285) with a proem dedicated to Constantine--Christian Hannick, "Byzantinische Musik," in H. Hunger, Handbuch der Altertumswissenschaft: Die Hochsprachliche Profane Literatur der Byzantiner II (Munich 1978) 184, associates this Constantine with Constantine VII Porphyrogennetus of the

tenth century, but all others assign Bacchius to the early fourth century A.D.--and so Porphyry apparently had access not to Bacchius but to Bacchius' source. It is just as possible that Porphyry had access not to Cleonides but to Cleonides' source.

One might also attempt to build an argument based on Cleonides' musicological proximity to Aristoxenus, e.g. that Cleonides and Aristoxenus alone of all the Aristoxenians avoid the use of musical notation, but this musicological proximity does not necessarily imply that Cleonides is also chronologically closer to Aristoxenus than the others.

18 For further attempts at attributing the treatise to Euclid, Cleonides, or another author, see Ruelle 3-10, and Jan, Die Harmonik des Aristoxenianers Kleonides (Landsberg 1870) 17-19.

MUSICOLOGY, ORGANIZATION, AND STYLE:

Despite our lack of knowledge about the life and date of Cleoindes, the treatise itself clearly delineates its author's musicological schoool and literary predecessors. As a musicologist Cleonides belongs to tha Aristoxenian school, for he postulates an equally divisible whole tone, a dia pason consisting of six whole tones, and numerous (thirteen) tonoi, postulates which the Pythagoreans do not hold. Cleonides even cites Aristoxenus in the treatise (25.6), and he cites no other musicologists.

The organization of the treatise also proves Cleonides to be Aristoxenian; he, along with the rest of the Aristoxenians--Aristoxenus, Bacchius, Gaudentius, Aristides, Alypius, (Bryennius)--discusses seven principle topics: Notes, intervals, genera, systems, tones, modulation, and melodic compostion. Aristoxenus first established these seven categories for discussion in his treatise: Genera (44.10), intervals (45.4), notes (45.11), systems (45.19), tones (46.17) modulation (47.17) and melodic composition (48.4).[1] Bacchius begins his treatise with a definition of μουσική, then proceeds to discuss note (#4), system (#5), and interval(#6).[2] Gaudentius, beginning with sound (#1), organizes his treatise in the same way as does Cleonides ; like Cleonides he lists all seven topics (Jan 327.5f.). Alypius almost echoes Cleonides,[3] as does Aristides, although he delays the introduction of these seven topics until his sixth chapter.[4] Like Gaudentius, Aristides lists all seven topics together at 7.9f. (all in the plural except μελοποιΐας). Similarly, Bryennius has other matters to discuss first in Book 1, but then he attacks in succession the topics of notes, intervals, systems, genus, tones, and modulation; he waits

until the third book to discuss melodic composition (3.10). And in addition to these structural parallels, the verbal parallels between Cleonides and the other extant Aristoxenian authors are enumerated throughout the beginning of the commentary.[5]

Specifically, Cleonides seems to represent a more conservative form of Aristoxenian musicology than do Gaudentius, Bacchius, Alypius, or Aristides. One can posit this statement, admittedly an argumentum ex silentio, since Cleonides is the only "Neo-Aristoxenian" not to include musical notation in his treatise. Bacchius (#11-18, 29-34, 39, and 41-42), Gaudentius (#22-23), Alypius (passim), and Aristides (1.9, 11) all include a form of musical (instrumental) notation with their writings, and it is only Aristoxenus himself and Cleonides who do not. Their avoidance is not an accidental omission, for Aristoxenus essentially forbade the use of notation (49.8f.): οὐ γὰρ ὅτι πέρας τῆς ἁρμονικῆς ἐπιστήμης ἐστὶν ἡ παρασημαντικὴ, ἀλλ' οὐδὲ μέρος οὐδέν... Notation, he continues, is an inexact way of representing intervals and notes, and the student who can read notation does not necessarily understand music.[6] We should therefore understand Cleonides' lack of notation as evidence not only of Aristoxenianism in his musicological thought, but of conservative Aristoxenianism.

On the other hand, Cleonides did not slavishly copy Aristoxenus' musicological works. Aristoxenus never lists the "mixed" genus as does Cleonides (6.11f.); Aristoxenus does not reduce the shades of the genera to numerical terms as does Cleonides (14.12f.); and Aristoxenus is not as well organized a pedagogue as Cleonides.[7] Furthermore, the numerous discrepancies between Aristoxenus' phrase-

ology and Cleonides' are listed throughout the commentary. Rather than "copy" Aristoxenus, Cleonides digests, rearranges, and developes Aristoxenus; but because so much of Aristoxenus' musicological writing is lost to us, one cannot hypothesize a more detailed musicological relationship between Aristoxenus and Cleonides.

The literary style of the treatise is singularly peripatetic, terse, unimaginative, efficient, and regularized. As an Aristoxenian, of course, Cleonides was an intellectual descendant of the Aristotelian tradition, and Aristotelian method abounds in the pages of the Εἰσαγωγὴ ἁρμονική. Cleonides tirelessly announces his subjects, defines them, divides them into categories, defines each category, and then proceeds to the next block of information.[8] As expected, he begins with the simplest and progresses to succeedingly more involved material.[9] While this pedagogically helpful progression from fundamental material to the advanced moves quite logically, Cleonides occasionally inserts advanced material into more fundamental material if it will serve his purpose. He details the complex non-modulating (ametabolic) system, for instance, at 23.14, but he has already mentioned it in his discussion of consonance and dissonance at 16.2 and referred to the τέλεια σύστημα at 8.5; in fact, Cleonides seems to assume prior knowledge on the part of the reader of at least the Greater Perfect System and Lesser Perfect System at 4.4-7.15 where he lists all the notes in these systems. In the same way, Cleonides divides the notes into the three genera at 3.12-7.15, but he does not actually present his discussion of genus until 11.9. Similarly, he inserts δύναμις prematurely at 3.10, but it is to be defined only at 23.16. Nonetheless, Cleonides certainly offers one of the, if not the clearest and simplest

introduction to Greek musicology still extant, and this clarity and simplicity no doubt helped to produce Cleonides' popularity in the Byzantine period. Still, no one should accuse Cleonides of spoon-feeding his reader; he rarely supplies the reader with detailed or even satisfactory definitions, and he is often niggardly with his examples and exegesis. It would be difficult for an uninitiated student to learn Greek musicology with one or even two readings of the Εἰσαγωγὴ ἁρμονική alone. The method is simple, but the material complex. As a result, when Cleonides starts from the rudiments and works logically toward the more complex aspects of Greek musicology, he does so, apparently, to organize rather than to introduce the knowledge of Greek music to his reader.

The organization of the treatise is the essence of Cleonides' progressive pedagogy. The reader is introduced to the term ἁρμονική from the first sentence (1.3), and from there he is presented with a list of the seven parts of harmonics: Notes, intervals, genera, systems, tones, modulation, and melodic composition (1.6f.). Thereafter come definitions of each of these seven terms (1.9-2.10), and then each of the seven terms is discussed in detail (2.11-29.7). The reader finds how sound is produced, and that certain sounds are called "notes" (φθόγγοι; 2.11-3.11). Notes are then listed by name and presented in various ways (3.12-9.2). With two notes one can form intervals between them, and therefore the next discussion is on intervals (διαστήματα; 9.3-11.8); Cleonides elaborates here on the difference between consonant and dissonant intervals (9.12-11.2). Once the reader is familiar with the various intervals--the quartertone, halftone, whole tone, etc.--he can then use these intervals to form the three

genera (γένη) and their shades (χρόαι) (11.9-15.2). The reader is now ready to form notes, intervals, and the three genera into systems (15.3-24.5). Within the system discussion Cleonides includes the lengthy material on the figures (σχήματα, εἴδη) of the various systems (17.4-21.3). As expected, the reader can now manipulate some of the systems as tones (24.6-26.18), and with all this material hopefully digested, the reader can now compose a melody (28.19-29.17). A detailed outline of the Εἰσαγωγὴ ἁρμονική follows:

I. Introduction to Harmonics (1.3-2.10)
   A. Definition of Harmonics (1.3-1.6)
   B. Seven parts of Harmonics (1.6-1.8)
      1. notes (φθόγγοι)
      2. intervals (διαστήματα)
      3. genera (γένη)
      4. systems (συστήματα)
      5. tones (τόνοι)
      6. modulation (μεταβολή)
      7. melodic composition (μελοποιία)
   C. Definitions of the Seven Parts (1.9-2.10)
      1. φθόγγος (1.9)
      2. διάστημα (1.11)
      3. γένος (2.1)
      4. σύστημα (2.2)
      5. τόνος (2.4)
      6. μεταβολή (2.6)
      7. μελοποιία (2.8)

II. The Seven Parts of Harmonics (2.11-29.7)

A. Notes (2.11-9.2)

1. acoustics (2.11-3.11)

2. names of notes (3.12-7.15

a. the three genera (3.12-4.3)

b. diatonic (4.4-4.22)

c. chromatic (5.1-5.19)

d. enharmonic (5.20-6.10)

e. mixed (6.11-7.15)

3. fixed and movable notes (7.16-9.2)

a. fixed and movable notes (7.16-7.25)

b. fixed notes: barypyknoi and apyknoi (8.1-8.7)

c. movable notes: mesopyknoi, oxypyknoi; diatonic (8.8-9.2)

B. Intervals (9.2-11.8)

1. five categories (9.2-9.6)

2. size (9.6-9.10)

3. genus (9.10-9.12)

4. consonant and dissonant (9.12-10.2)

5. composite and non-composite (10.2-11.2)

6. rational and irrational (11.2-11.8)

C. Genus (11.9-15.2)

1. five types of melody (11.9-11.18)

a. diatonic

b. chromatic

c. enharmonic

d. common

e. mixed

2. the movable notes in the genera (11.18-12.5)

3. the shades (12.6-15.2)

a. the six shades (12.6-14.11)

i. enharmonic (12.9)

ii. soft chromatic (12.12)

iii. hemiolic chromatic (12.15)

iv. tonic chromatic (13.3)

v. etymology of the names (13.5)

vi. soft diatonic (14.5)

vii. syntonic diatonic (14.9)

b. numerical representation of the shades (14.12-15.2)

D. Systems (15.3-24.5)

1. the seven differences between systems (15.3-21.3)

2. size (15.9-15.12)

3. genus (15.12-15.13)

4. consonance and dissonance (15.14-21.3)

a. six disjunct consonances (16.2-16.16)

b. four conjunct consonances (16.16-16.20)

c. larger consonances and dissonances (16.20-17.3)

d. figures of the systems (17.4-21.3)

i. definition (17.4-17.8)

ii. figures of the dia tessaron (17.8-18.8)

iii. figures of the dia pente (18.9-19.3)

iv. figures of the dia pason (19.4-21.3)

5. rationality and irrationality (21.4-21.7)

6. consecutiveness and non-consecutiveness (21.8-21.10)

7. conjunction and disjunction (21.11-23.13)

a. definition of conjunction and disjunction (21.14-22.9)

b. the two perfect systems (22.10-23.7)

c. the ametabolic system (23.8-23.13)

8. modulation and non-modulation (23.14-24.5)

E. Tones (24.6-26.18)

1. as notes (24.8-25.1)

2. as intervals (25.2-25.3)

3. as a location of the voice (25.4-26.15)

a. definition (25.4-25.6)

b. the thirteen tones (25.7-26.15)

4. as "tuning" (26.16-26.18)

F. Modulation (26.19-28.18)

1. the four types of modulation (26.19-27.2)

2. by genera (27.2-27.4)

3. by systems (27.5-27.6)

4. by tones (27.6-27.10)

5. emmelic and ekmelic modulation (27.10-28.2)

6. by melodic composition (28.3-28.18)

G. Melodic composition (28.19-29.7)

1. the four types (29.1-29.2)

2. ἀγωγή (29.2-29.3)

3. πλοκή (29.3-29.4)

4. πεττεία (29.4-29.5)

5. τονή (29.5-29.7)

III. Conclusion (29.8-29.17)

[A. Diagrams (29.8-29.9)

B. Function (29.10-29.12)

C. Melodic Composition (29.13-29.15)]

D. The limit of Harmonics (29.16-29.17)

The succinctness of Cleonides' style is manifested in two ways: He rarely expands upon his definitions, and he is quite often frugal with his examples. Occasionally he offers prosaic details of his definitions, e.g. the emmelic and ekmelic modulations (27.10-28.2), but otherwise he defines a term with one (unqualified) sentence and then proceeds to the next step.[10] Were Cleonides' definitions clear, his reader would not expect elaboration. But more often than not Cleonides' peripatetic definitions do not really define; they merely take the reader around in a circle by repeating the term to be defined, e.g. his definition of rational and irrational systems (21.4-21.7).[11] When Cleonides does include examples, and he does not always do so, there is frequently only one offered, and this reluctance to offer elaboration increases towards the end of the treatise. Such terseness betrays his peripatetic background; it brought about several Byzantine additions to the text, e.gg 9.9 and 9.18. One wonders if Cleonides wrote this treatise in circumstances similar to Nicomachus' when the latter admits that a hurried assemblage of material is all he can muster in the time allotted; cf. Nicomachus 237-38.

The prose of the treatise is entirely technical[12] although Cleonides (or his source) does embellish the work somewhat by the utilitarian quoting of two poetic fragments from Terpander and Ion (24.10f.). Cleonides often repeats his phraseology (e.g. 15.4, 21.4, 21.8, 21.11 and 23.14, or 24.6 and 26.19), but he is not incapable

of making variations in terminology (e.gg. εἴδη (17.9) for σχήματα (17.4) and addding or omitting νητῶν to the names of the upper tetrachords (22.3f.)).[13] Normally he will be consistant within a passage, but in separate passages he may vary his phraseology slightly, e.gg. ᾗ (9.3f.), ἥ (11.10f.), ἡ (15.4f.), or δέ (19.8f. and 20.14f.).

His grammar is simple, with many sentences having no verb other than εἶναι. μέν--δέ clauses appear frequently, and the δέ-clause often omits the form of εἶναι and all other unessential, i.e. repeated, words.[14] Fond of organized, unified sentences, he shows a preference for τε καί over simple καί(cf. <u>infra</u>, comm. 1.3), and he begins series of definitions frequently with μὲν οὖν, e.g. 3.3f. Typically peripatetic in his vocabulary, he often uses τὸ plus neuter participle plus prepositional phrase, e.g. 3.3f. He very rarely uses such elaborate constructions as genitive absolutes (23.8, 20; 24.1), optatives (17.6) or subjunctives (25.2, 4; 27.4, 6, 9, 21; 28.5--all in ὅταν clauses). The indicative with simple subjects[15] modified by genitives, simple participles and prepositional phrases is the rule. He conscientiously and repeatedly describes intervals in an ascending direction. He invents no new technical terms though there is an apparent <u>hapax</u> at 28.15 (ἠρεμότης). One knows what to expect. The only defense one could make for Cleonides' style is that he probably had little concern for his prose, and this same type of barren prose fills the pages of Bacchius, Alypius, and Gaudentius. It gets the job done.

NOTES

1

Aristoxenus' order differs from that of Cleonides, and Aristoxenus discusses genera and intervals only after introducing all seven categories in Book 2. Cleonides' order--notes, intervals, genera, systems, tones, modulation, and melodic composition--is more logical, for notes and intervals are both a *sine qua non* for the existence of genera and systems.

2

His order of presentation differs again from those of both Cleonides and Aristoxenus. At #21 he begins to discuss genus and at #46 tones, which he calls τρόποι. At #50 he mentions seven types of modulation; Cleonides listed only four.

3

3

[Τοῦ ἁρμοσμένου] μέρη ἑπτά· πρῶτον περὶ φθόγγων, δεύτερον περὶ διαστημάτων, τρίτον περὶ συστημάτων, τέταρτον περὶ γενῶν, πέμπτον περὶ τόνων, ἕκτον περὶ μεταβολῶν, ἕβδομον περὶ αὐτῆς τῆς μελοποιίας; cf. comm. 1.7.

4

διάστημα(#7), σύστημα (#8), γένος (#9), τόνοι (#10), μεταβολή (#11), and then μελοποιία (#12). This is followed by ῥυθμός (#13).

5

See especially where their basic definitions are parallel, e.gg. in the commentary to 1.9, 1.11, 2.1, 2.2, etc.

6

Aristoxenus later (49.12f.) specifies: οὐ γὰρ ἀναγκαῖόν ἐστι τὸν γραψάμενον τὸ φρύγιον μέλος καὶ ἄριστά γε εἰδέναι τί ἐστι τὸ φρύγιον μέλος.

7

This may not be a fair approximation of Aristoxenus' organizational abilities since we only have parts of the Ἀρχαι and Στοιχεῖα.

8

Cf. 1.3-2.10 or 3.12-4.3.

9

E.g. from single notes to intervals (two notes) to genera (four notes).

10

At 1.11 he adds some extra (non-essential) terms to his definition of διάστημα, but these extra terms only confuse the reader.

11

Τῇ δὲ τοῦ ῥητοῦ καὶ ἀλόγου διαφορᾷ διοίσει συστήματα, ὅσα ἐκ ῥητῶν διαστημάτων συγκεῖται, τῶν ἐξ ἀλόγων. ὅσα μὲν γὰρ ῥητὰ ἐκ ῥητῶν ἐστιν, ὅσα δὲ ἐξ ἀλόγων ἄλογα. No examples follow.

12

Occasionally even formulaic; cf. 3.12f.

13

His repetition of terms can be contrasted with the style of Gaudentius and Ptolemy, who forcibly employ synonhms instead of repeating terms, sometimes at the expense of clarity.

14

E.g. 4.4-5.1: Εἰσὶ οὖν οἱ μὲν ἐν τῷ διατόνῳ φθόγγοι οἵδε and Ἐν δὲ χρώματι οἵδε.

15

Singular verbs always accompany neuter plural subjects; cf. comm. 1.6.

1.2 The method for assigning a title to this treatise by necessity accompanies the search for an author. Fortunately the tradition is not nearly so variegated here as it was in the attribution problem, but few of the important manuscripts and manuscript families agree on Εἰσαγωγὴ ἁρμονική. Only M^1C^1 have this title, while MCP omit the title altogether. The Arabs knew of an Euclidean Sharḥ al-rumūniqī (see supra, p. 163). Some of the inferior manuscripts have variants which can be ignored.

The word εἰσαγωγή has various technical meanings referring to the importation of goods, the raising of taxes, and the introduction of cases into a law court as well as the channel of a harbor entrance. It also refers (LSJ III) to the introduction of an educational subject. Cleonides uses the word to mean "an elementary treatise" as does Chrysippus in his Εἰσαγωγὴ εἰς τὴν περὶ ἀγαθῶν καὶ κακῶν πραγματεία; the word πραγματεία is often connected with an εἰσαγωγη as in Vat. Reg. 169 (Εὐκλείδου εἰσαγωγὴ ἁρμονικῆς πραγματείας ὅρος ἁρμονική); The word πραγματεία appears elsewhere in Cleonides' treatise--2.8f. and 29.14.

Bacchius also titled his treatise on harmonics Εἰσαγωγὴ τεχνῆς μουσικῆς; Gaudentius Ἁρμονικὴ εἰσαγωγή; Alypius Μουσικὴ εἰσαγωγή. Nicomachus calls his treatise an ἐγχειρίδιον. Euclid called his lost [?] musical work something resembling αἱ κατὰ μουσικὴν στοιχειώσεις (Proclus) or μουσικῆς στοιχεῖα (Marinus). Clearly, εἰσαγωγή was not the only choice for the title of an introductory musicological treatise in antiquity, but it was certainly an extremely common title for many types of technical treatises. Some other examples are Nicomachus' Εἰσαγωγὴ ἀριθμητική and Paulus Alexandrinus' astrological work which ap-

parently was titled Εἰσαγωγικά. See E. Boer, ed., Elementa apotelesmata (Leipzig 1958).

For a full treatment of the word εἰσαγωγή as a title for technical treatises, see Karl Theodore Schäfer, "Eisagoge," Real-lexicon für Antike und Christendum IV 862-904. Geminus, who seems to be the first author to use this word as a title, wrote his Εἰσαγωγὴ εἰς τὰ φαινόμενα in the first century B.C., and Johannes Damascenus wrote his Εἰσαγωγὴ δογμάτων στοιχειώδης as late as the eighth century A.D.; these dates give us some help in dating the treatise of Cleonides and thus in helping to eliminate the Euclidean attribution (but only if the treatise is indeed an εἰσαγωγή. Other titles for technological treatises in Greek were Περὶ ...(e.g. Aristoxenus' Περὶ τραγῳδοποιῶν and many titles in Plutarch's Moralia), Τέχνη ...(e.g. Dionysius Thrax' Τέχνη γραμματική), and the nominative neuter plural (e.gg. Euclid's Κωνικά, Ψευδάρια, and Πορίσματα).

1.3 The omission of the first few sentences in P accompanies another interesting variant--the use of the following fourteen words (περὶ φθόγγων--περὶ μελοποιίας (1.8)) in a titular function. Since P uses these seven categories as title, the nouns συστημάτων, τόνων, and μεταβολῶν have accordingly been changed to the plural.
U omits τε: Elsewhere in the treatise, the combination of τε καί appears quite a number of times: 2.12, 13, 14, 17; 9.4; 14.4; 15.4; 17.2; 23.3, 4, 10; 27.13; 28.16. Cleonides once uses καί...καί where he might have used τε καί (20.13). If one can infer Cleonides' stylistic preference from this data, he would read τε καί with little hesitancy. U commits the same error again in line 5.

ἁρμονικός can mean simply "skilled in music" (Pl. Phaedr. 268 D) or "musical," as it means here. Aristoxenus named one of his musical treatises Ἁρμονικὰ στοιχεῖα, and so the word has it precedent well established for the post-Aristoxenians; cf. Alypius 367.2, Gaudentius 327.8. Bacchius, however, generally prefers the word μουσικός. The Pythagoreans also use the word, e.g. Nicomachus' Ἁρμονικὸν ἐγχειρίδιον. The word is used in the same "musical" sense in [Plut.] 2.114 F; Arist. Metaph. $1077^{a}5$ and Top. $107^{a}16$. The word can also refer to the enharmonic genus, e.g. [Plut.] 1133 E, though Cleonides prefers the adjective ἐναρμόνιος, e.gg. 11.10-11, 13.

ἁρμονικός also has a purely mathematical significance, e.g. Nicomachus Ar. 2.22 and Theon 114. The word originates, of course, in the verb ἁρμόζω ("to join, fasten") which can be found in Homer and in connection with various crafts and sciences, e.gg. shipping, masonry, anatomy, and government. As a musical term ἁρμόζω generally means to "tune an instrument" (Pl. Rep. 591 D), but the derivative noun ἁρμονία can mean "an early form of scale" (e.g. Aristides 19.8 and Pi. N. 4.46) and the "enharmonic scale." The early scales called ἁρμόνιαι were basic tools for Aristoxenus' predecessors whom he described as "Harmonists" (Ἁρμονικοί). These scales are described in some detail by Aristides (19f.).

There is a relatively large amount of bibliography on these matters. See Antoine Auda, Les Gammes musicales (Woluwé-St. Pierre 1947) 49-77; J. Chailley, "Le mythe de modes grecs," Acta Musicologica 28 (1956) 137-63; O. J. Gombosi, "Key, Mode, Species," Journal of the American Musicological Society 4 (1951) 20-26; M. I. Henderson, "The Growth of Ancient Greek Music," The Music Review 4 (1942) 4-13;

Henderson, "The Growth of the Greek ἁρμονία," CQ 36 (1942) 94-103; D. B. Munro, The Modes of Ancient Greek Music (Oxford 1894) 47-65; Kathleen Schlesinger, "The Harmonia, Creator of the Modal System of Ancient Greek Music," The Music Review 5 (1944) 7-39, 119-41; Matthew Shirlaw, "The Music and Tone Systems of Ancient Greece," The Music Review 4 (1943) 14-27; and R. P. Winnington-Ingram, Mode in Ancient Greek Music (Cambridge 1936).

It should be understood that Cleonides prefers the word ἁρμονική to μουσική. The former implies a science, the latter a craft, and Cleonides intends this treatise to be entirely scientific and analytic, not "musical"; but cf. Bacchius' title.

πρακτική means "concerned with action, practical" and is used in opposition to and in connection with θεωρητικος, "concerned with the mind, contemplative, speculative" in Aristotle (EN $1139^{a}27$). Both words have widespread Peripatetic use. θεωρητικός is used with ἐπιστήμη and takes the genitive in Pl. Def. 414 B, and it is found with φύσεως in Arist. PA $641^{a}29$; cf, also Bryennius 172.26.

φύσεως (φύσις) has a multitude of meanings outside of philosophy, and even within the discipline it carries many shades of meaning (LSJ IV). "Nature" can refer to a "creative principle" (Arist. Metaph. $1014^{b}16$) and it can also refer to an "elementary substance" (LSJ IV.2) such as earth, air, fire, or water. Cleonides uses the term not in a philosophical sense, but in a physical sense (LSJ II.1, cf. Arist. PA $648^{a}21$ φύσις αἵματος and Pl. Rep. 525 C ἡ τῶν ἀριθμῶν φύσις) meaning "nature" or "constitution." ἡ τοῦ ἡρμοσμένου φύσις refers to the "nature" or "properties" of harmonics. It implies some reference to the origin of harmonics, i.e. whence and how music is formed, as

well as to the condition of harmonics once formed.

Strunk translates θεωρητική as "speculative," and some prefer the philosophical term "comtemplative." In translating the term as "theoretical" I follow Ruelle and Davy. Cf. Menge (considerandi), Meibom (contemplatur), and Pena (contemplandi). "Speculative" has a connotation which includes a slight amount of frivolity. Harmonics had mental and physical, but not purely intellectual applications; "theoretical" serves as the best twentieth-century antonym for "practical."

1.4 U incorrectly adds the verb ἐστι to this sentence, although the parallel sentences in Aristides (4.20) and Bryennius (172.26) have the verb as well. There are a number of definitions in this peripatetic treatise, and almost all of these include some form of the linking verb εἶναι. Usually, however, the first definition in a series contains ἐστι but the second omits it, e.gg. 1.9-11, 9.7-10, 9.14-15, 9.19-10.1, 10.3, 10.5-8.

ἡρμοσμένον is the perfect passive participle of ἁρμόζω; the middle participle refers to "tuning one's own lyre" (Pl. Rep. 591 D). As a passive particple the word means simply "that which has been constructed by harmony, harmonics." Used in this way, the word is apparently not of classical origin (LSJ I.5). Aristoxenus uses the word reasonably often conjoined with the word μέλος: 20.18, 23.17; he aslo uses it in the general sense, e.gg. 24.8, 11, 18, and especially 8.13-14 (ἡ τοῦ ἡρμοσμένου καὶ μελῳδουμένου [φύσις]). Aristides uses the neuter participle as a substantive as well in 92.26-7; Bryennius in 52.22f et al.

In translating τὸ ἡρμοσμένον as "harmony," I assume readers understand that no reference to later European "harmony" is being made. Many technical terms in Greek musicology are necessarily rendered into English with modern musicological vocabulary, but the actual meaning and employment of the word is also necessarily quite often different. One has little choice in translating τὸ ἡρμοσμένων. Strunk uses "the harmonious," but this will not fit later in the treatise. Cf. Davy ("Harmony"), Ruelle ("Le chant accorde), Meibom ("modulata series") and Pena ("concentus"): Menge simply transliterates with "harmonice."

1.5 τάξιν τῶν συγκειμένων ἔχον would necessitate an odd syntax; τῶν συγκειμένων would have to refer to φθόγγων and διαστημάτων, and ἐκ would thereby make very little sense as it stands, i.e. "the harmonic material is that which contains a certain arrangement [made] out of notes and intervals which are arranged together."

τάξις (from τάσσω) refers to an orderly arrangement of something, especially troops, e.g. Aesch. Pers. 298. The word can refer to an orderly arrangement of days, of one's disposition, and of words or thoughts. In this last sense the word became closely associated with rhetorical word order (Arist. Rhet. $1414^{a}29$). Not surprisingly, in the fourth century the Greeks extended the meaning of "a careful arrangement" to "order or regularity" (Pl. Gorg. 504 A τάξις καὶ κόσμος). Theophrastus (HP 3.9.6) used the expression τάξιν ἔχειν to mean "to be regular"; Cleonides here uses (ποίαν) τάξιν ἐχόντων (φθόγγων τε καὶ διαστημάτων) to signify "(a certain kind of) regularity (in notes and intervals)."

σύγκειμαι serves as the passive of τίθημι and means "to be composed, compounded." The Latinate English word "composed" could not

have been better formed in that it literally means "put together" and now also means "written, as in music." One should not, however, be misled into thinking of a Greek "composer" actually "writing," i.e. making music--τὸ ἡρμοσμένον. For the Greeks, harmonics was a science which had a nature (φύσις) all its own and could not therefore be man-made and "composed." Aristoxenus, Aristides, and Bryennius use the verb σύγκειμαι quite often.

1.6 The difference between εἶσιν (U) and ἐστιν (cett.) in agreement with a neuter plural subject, μέρη, is, of course, slight, especially since medieval hands could write both words with an abbreviation ( ); see E. M. Thompson, An Introduction to Greek and Latin Palaeography (Oxford 1912 and reprint: 1973) 84. Greek prose generally required a singular verb with a neuter plural subject, especially in Attic, except where the plurality of parts within the neuter plural noun is stressed (Smyth 959). In this case the word μέρη by its very nature stresses the seven parts of ἁρμονική, and so the plural might be expected. But, elsewhere in the treatise there are thirty-seven examples of neuter plural subjects: 2.11; 3.1, 12; 9.7, 10, 12, 17; 10.3/4, 5, 10, 17-11.1; 11.3, 4, 9; 13.5; 15.9-10, 14; 16.2; 17.2, 4, 9, 16-17; 18.3, 6-7, 9; 19.4; 21.1, 4-5, 6, 8-9, 11-12, 13; 22.10, 13; 23.10, 15, and 16. In every one of these instances the singular verb is used; the plural verb is never found with a neuter plural subject.

Each of these technical terms--φθόγγος, διάστημα, γένος, σύστημα, τόνος, μεταβολή, and μελοποιία--will be discussed in full where Cleonides does so: 1.9 and 2.11(φθόγγος); 1.11 and 9.3(διάστημα); 2.1 and 11.9(γένος); 2.2 and 15.3(σύστημα); 2.4 and 24.6(τόνος); 2.6 and

26.19(μεταβολή); 2.8 and 28.19(μελοποιία).

The addition of περὶ before each of the seven parts of harmonics derives from the regular Hellenistic method of describing treatises; cf. supra, n. 1.2. Since each part is then best translated "On ...," αὐτῆς is rendered best as "of the study of harmonics" rather than the more grammatical "of harmonics." Strunk prefers to translate without rendering the περὶ into English

1.7 Cleonides will define these seven parts of harmonics in order, and this order is foreshadowed here in 1.6-8. The emended transposition in Q of διαστημάτων after συστημάτων is most probably, therefore, incorrect. MC are also incorrect in transferring περὶ μελοποιίας to just after γενῶν.

The manuscript evidence does not weigh heavily either for keeping συστήματος, τόνου, and μεταβολῆς in the singular (MC) or making them plural (PU). (There is, of course, no functional plural for μελοποιία.) It is hard to explain, however, why Cleonides would have written or thought of "system" in the singular, for there are different types of systems; cf. 15.3f. Greek musicology also provides for different types of τόνοι, so I favor making both terms plural; where P reads μεταβολῶν, however, I maintain the singular. On the other hand, there are four distinct types of μεταβολή. Cleonides says so at 26.19 and he uses the plural μεταβολαί at 27.10. P, however, is still the only manuscript which reads μεταβολῶν, and P is not necessarily a good manuscript to follow in this early part of the treatise. It omits the title of the work and the first three sentences, listing these phrases as titles. But if there are four types of tones, many types of notes, and seven types of systems,

why would Cleonides have written some in the plural and some in the singular? If P is unreliable here, MC err in transposing περὶ μελοποιΐας to after γένων. None of the manuscripts is ideal here. See also the parallel from Alypius 367.12f. which has all seven of the categories in the plural except for the last.

For these seven categories as Aristoxenian topics, see supra, p. 175f.

1.9 The sub-titles Περὶ φθόγγων (φθόγγου Q) καὶ τῶν λοιπῶν(QN) probably derive from an annotated text, some of which still exist for this treatise, e.gg. Londiniensis B.M. add. 27863 and Parisinus Supp. fr. 449. Other sub-titles can be found at 24.6 and 29.10.

Jan, following Vat. Reg. 169, capitalizes the first letter of each definition and awards each its own paragraph. Although this is unnecessary, I follow Jan's arrangement for the sake of convenience.

For parallel definitions of φθόγγος, see supra, p. 175f.

ἐμμελής modifies πτῶσις and signifies that the πτῶσις is harmonious, orderly, or in tune. (Strunk renders ἐμμελής as "harmonious" but he confuses ἐμμελής with τὸ ἡρμοσμένον(which he already translated as "the harmonious.")) Cleonides (2.11f.) and most of the other Greek musicologists carefully distinguish between random sound and orderly sound; only the latter can be classified as music. Well aware of this distinction, Cleonides is careful to use words such as ἡρμοσμένον, τάξις, and ἐμμελής in his introductory statements before employing the truly technical term φθόγγος. ἐμμελής has a quasi-technical significance for the Greek musicologists in opposition to ἐκμελής. Both these technical terms Cleonides discusses at 27.13f.

Here, however, the word is not really used in a technical sense; Cleonides simply refers to a "tuneful, musical" note (φωνή) as opposed to "noise" or a semi-musical sound that has no distinguishable pitch. See also infra, 27.13 and Davy II 311-12.

φωνή refers to a "sound, tone." Homer (Il. 2.490) used the word to describe a human's voice, but φωνή can also refer to animal sounds, e.g. [Aris.] Prob. 895^{a}4 (incorrectly) ἄνθρωπος πολλὰς φωνὰς ἀφίησι, τὰ δὲ ἄλλα μίαν. The word is usually distinct from a noise (ψόφος). Plato (Rep. 397A) also uses φωνή to mean the sound of a musical instrument, but Aristoxenus usually uses the technical phrase φωνὴ ὀργανική (19.5) to specify an instrumental sound. Cleonides here refers simply to a musical sound. He is not concerned with distinguishing human voice and instrumental timbre, only in distinguishing a general musical sound (φωνή) from a specific musical sound (φθόγγος). Cleonides will develope this distinction at 2.16-3.9.

τάσις ("tuning"), as Cleonides will make evident at 2.19f., is the same as φθόγγος, only a τάσις is produced by an instrument, i.e. by "stretching" a string, while a φθόγγος is produced by the human voice. Both words are easily translatable as "note." Aristoxenus (17.3) refers to τάσις as μονή τις καὶ στάσις τῆς φωνῆς," a dwelling and stationary placement of the voice," which is a definition not too different from Cleonides' (and Aristoxenus') definition of φθόγγος. Similar is Anonymous Bellermann (#21) στάσις καὶ ἐνηρέμησις τῆς φωνῆς, "a stationary placement and stillness of the voice"; this treatise repeats Aristoxenus' words at #39. Cf. [Plut.] 2.1020 E, 1133 C and infra 2,19. Strunk translates Cleonides' τάσις as "pitch"; I prefer a less technical "tuning" at this early stage of the explanation; cf. 3.7.

τάσις also refers to word accents (D.H. Comp. Verb. 19) and to other forms of "stretching" or "tension," even in such medical contexts as Soranus 2.19 and Galen 10.66.

1.11 This is the only definition of these seven in which Cleonides omits a form of εἶναι. For a full discussion of the word διάστημα, see infra, 9.3-11.8.

περιέχω has several different technical usages, but not in musicology. Some of the other Aristoxenians define διάστημα with different wording: Aristides 10.16--ἰδίως δὲ κατὰ μουσικὴν γίνεται διάστημα μέγεθος φωνῆς ὑπὸ δυεῖν φθόγγων περιγεγραμμένον; and Aristoxenus 20.20--διάστημα δ' ἐστι τὸ ὑπὸ δύο φθόγγων ὡρισμένον μὴ τὴν αὐτὴν τάσιν ἐχόντων. But Bacchius (#6) has Διάστημα δὲ τί ἐστι; Διαφορὰ δύο φθόγγων ἀνομοίων ὀξύτητι καὶ βαρύτητι. Gaudentius (#3) uses περιεχόμενον but omits ἀνομοίων ὀξύτητι καὶ βαρύτητι.

ἀνομοίων can be found used in Bacchius' definition of interval as well, and it appears sporadically in the other musicologists. Cleonides adds this somewhat superfluous word to his definition of interval since he wishes it made clear that two notes falling at the same pitch do not have an interval between them. Cleonides rarely opts for superfluity in his definitions, but when he does it can lead to confusion. Similarly, Gaudentius here omits ἀνομοίων and is equally confusing. Qualifications which when omitted cause a small misinterpretation can when added lead the reader to a greater misunderstanding.

2.1 Fuller discussions of γένος will be found infra at 3.12-7.14 and 11.9-15.2. Other Aristoxenians define the word similarly; (Aristoxenus does hnot define the word in his extant treatises). Aristides

(15.21) has γένος δέ ἐστι ποιὰ τετραχόρδου διαίρεσις; Bryennius (112.13-14): γένος τοίνυν ἐστὶν ποιὰ τεττάρων φθόγγων, ταύτο δ' εἰπεῖν τετραχορδου διαίρεσις; Bacchius (#21): γένος δὲ τί ἐστιν; Ἡ ἐν τετραχόρδῳ γενομένη διαίρεσις; and Gaudentius (#5): γένος δέ ἐστι ποιὰ τετραχορδον [sic Jan] διαίρεσις καὶ διάθεσις.

διαίρεσις has technical connotations in mathematics (Euc. 5 Def. 15), grammar, metrics, rhetoric, medicine, logic, and philosophy. Plato most notably used the word to describe the process of separating forms of reality, e.g. Sph. 267 D. Cleonides does not refer to so elaborate a process, nor does he seem to take the word from any other discipline. Cleonides refers not so much to a simple division of four notes as to "a special group of arrangements" of four notes. No other discipline seems to have used διαίρεσις in this sense of "arrangement"; perhaps this sense of the word is germane to musicology.

2.2 For a discussion of σύστημα , see infra, 15.3-24.5. Cleonides uses συγκείμενον in a way similar to his use of the word at 1.6. Other Aristoxenians define σύστημα in the following ways, as expected, closely resembling the definition of Cleonides: Aristides (13.4-5): σύστημα δέ ἐστι τὸ ὑπὸ πλειόνων ἢ δυεῖν διαστημάτων περιεχόμενον; Aristides differs from Cleonides in saying that a system consists of more than two intervals, while Cleonides asks for only one more than one. Bryennius (102.24-25) parallels Cleonides: σύστημα τοίνυν ἐστὶ τὸ ἐκ πλειόνων ἢ ἑνὸς διαστημάτων συγκείμενον, as does Bacchius (#5): σύστημα δέ τί ἐστι; Τὸ ἐκ πλειόνων ἢ δύο φθόγγων μελῳδούμενον, although not quite as closely; Bacchius, too, asks for more than two intervals. Gaudentius (#4) reverts to Cle-

onides' definition: ἁπλῶς γὰρ σύστημά ἐστι τὸ ἐκ πλειόνων ἢ ἑνὸς διαστημάτων συγκείμενον διάστημα. Ultimately, of course, the definitions of both Cleonides and Gaudentius echo that of Aristoxenus (21.15): τὸ δὲ σύστημα σύνθετόν τι νοητέον ἐκ πλειόνων ἢ ἑνος διαστημάτων.

2.4 Some of the manuscripts (CU) accent τις, but the word is a monosyllabic enclitic and should remain unaccented.

For a discussion of τόνος, see infra, 24.6-26.18. The definition which Cleonides gives here--he gives a different version at 24.6--does not resemble Bacchius'. Bacchius uses the word τρόπος instead of τόνος and defines it as πλοκῆς ἐμμελοῦς σχῆμα. Gaudentius does not define the word, nor does Aristoxenus. Bryennius' definition parallels Cleonides, (116.9): τόνος τοίνυν ἐστὶ τόπος τις τῆς φωνῆς δεκτικὸς συστήματος ἁπλατής. Aristides (20.3-4) simply offers a synonym: τρόπον συστηματικόν.

δεκτικός refers generally to anything "fit for or capable of receiving" something. Aristotle uses the word frequently, but it is found only infrequently in Greek musicology; cf. Aristides 47.10, 102.8, 104.2, 108.29, 124.21; Aristoxenus 21.2f.; Bryennius 98.15. It does not seem to be a technical term. ἁπλατής, however, is a technical term meaning "without breadth"; Aristotle (APr. $49^{b}36$) uses the word to describe a thin line. According to Michaelides, "Aplates" 24, Aristoxenus (7.20f.) first proclaimed that sound had "no breadth." But the texts of da Rios and Macran have πλάτος, not ἁπλατής. Elsewhere the word appears in the Pythagorean Nicomachus (in a bracketed passage--242.21-243.1, 261.6) and in Porphyry (82.4-5). Jonker translates the word at Bryennius 116.9 as "latitude" (i.e. "variation"; literally, "breadth"). He discusses the problem (386-89), as does

Davy II 313-14. Cf. also the translations in Pena, Menge, Meibom ("latitudine carens"), Forcadel ("n'ayant point de latitude"), Ruelle ("sans largeur"); see also Ruelle's (16) note: "Allusion à la ligne geométrique, qui est considérée indépendamment de la largeur"; Ruelle also refers to Henri Martin, Études sur le Timée de Platon I (Paris 1841) 393, n. 5.

2.6 For a discussion of μεταβολή , see infra, 26.19-28.18. Other Greek musicologists define μεταβολή differently: Bacchius (#58): Μεταβολὴ δὲ τί ἐστιν; Ἑτεροίωσις τῶν ὑποκειμένων ἢ καὶ ὁμοίου τινὸς εἰς ἀνόμοιον τόπον μετάθεσις. Gaudentius offers no definition. Bryennius 120.5-6: Μεταβολὴ τοίνυν ἐστὶν ὁμοῖον τινὸς εἰς ἀνόμοιον τόπον μετάθεσις ἢ ἀλλοίωσις τοῦ ὑποκειμένου συστήματος καὶ τοῦ τῆς φωνῆς χαρακτῆρος; similarly, Aristides (22.11-12): Μεταβολὴ δέ ἐστιν ἀλλοίωσις τοῦ ὑποκειμένου συστήματος καὶ τοῦ τῆς φωνῆς χαρακτῆρος.

μετάθεσις is not a technical term in musicology. It cannot be found in the other musicological treatises except in the parallel definitions of Bryennius and Bacchius quoted here. The word refers to any "transposition" or "change." Grammatical metathesis (A.D. Pron. 51.5) has a more specific meaning which will not apply to "modulation"; modulation (μεταβολή) is a mere change, not a reversal of order.

Jan suggest a reading of τύπον (?beat, blow") for τόπον here, citing Aristides (22.11f.) and his own Bacchius (Strasbourg 1891) 22 for support. The manuscripts for Bacchius #58, however, unanimously support τόπον even though Jan here also wishes to read τύπον. "Modulation is the transferal of something similar into a dissimilar striking (of the note)" is misleading. The note does not modulate, the system or genus

does. "Modulation is the transferal of something similar into a dissimilar spot" makes more sense. (That is, playing hypate meson while modulating from diatonic to the chromatic genus, the note (τόπος φωνῆς) does not change but the genus does.)

2.8-10 For a discussion of μελοποιία, see infra, 28.19-29.15. The manuscripts have Cleonides apparently repeat this definition at 29.13. Other authors define μελοποιία thus: Aristoxenus (48.5f.) defines the term vaguely: ἐπεὶ γὰρ ἐν τοῖς αὐτοις φθόγγοις ἀδιαφόροις οὖσι τὸ καθ' αὐτοὺς πολλαί τε καὶ παντοδαπαὶ μορφαὶ μελῶν γίγνονται, δῆλον ὅτι παρὰ τὴν χρήσιν τοῦτο γενοῖτ' ἄν. καλοῦμεν δὲ τοῦτο μελοποιίαν. A little more specific is Aristides (28.10-11): μελοποιία δὲ δύναμις κατασκευαστικὴ μέλους. Bryennius (360.19f.) is the most complete; of interest is his obvious use of both Cleonides and Aristides as his sources: Μελοποιία δέ ἐστι χρῆσις τῶν ὑποκειμένων τῇ ἁρμονικῇ πραγματείᾳ πρὸς τὸ οἰκεῖον ἑκάστης ὑποθέσεως ἢ δύναμις κατασκευαστικὴ μέλους.

χρῆσις is a musicological term employed by Aristides (29.7) in referring to a specific type of μελοποιία; it includes ἀγωγή, πεττεία, and πλοκή, for which see Cleonides 29.1-5. Otherwise, the word is only a quasi-technical term and means simply "use." For other musicological examples, see Aristides 197, Bryennius 114.3, Bacchius #2, Gaudentius 332.2, [Ptol.] 413.3.

μελοποιία is difficult to render as one word. Strunk and I both use "melodic composition." Davy maintains a Hellenic "melopoeia," as do Forcadel and Ruelle ("mélopée"), and Pena, Menge, and Meibom ("melopoeia").

2.11-3.11 While it is not initially clear, Cleonides now embarks upon his first topic, φθόγγοι and begins the main body of his treatise. Even if he has just completed his preliminaries--the definition of ἁρμονική , the seven topics it involves, and the definition of each topic, he has not made a clear demarcation between those preliminaries and this incipient section on notes. Elsewhere in the treatise Cleonides will introduce each of the six sections with the appropriate term first (or at least third after the article and particle) in the initial sentence: τῶν δὲ διαστημάτων (9.3), γένη (11.9), τῶν δὲ συστημάτων (15.3), τόνος (24.6), μεταβολή (26.19), μελοποιΐα (28.19).

Cleonides' discussion begins, as do most Greek musicological treatises, with the production of sound. For parallels, see Bryennius 86.1-90.7, Nicomachus #2, Porphyry 194, Aristoxenus 13.14-15.6, Aristides 5.22-6.7, Gaudentius #1, [Ptol,] 413, Sectio Canonis 148.3-149.6, Ptolemy 1.3-4. Such a discussion on acoustics served as an almost obligatory homage to the founder of musicology, Pythagoras. Pythagoreans and Aristoxenians differ, of course, in their approach to acoustics; they argue as to which intervals are consonant and about the shades of the genera. But the general approach is the same whether it is found in Aristoxenus, Cleonides, or Nicomachus: Sound (φωνή) results from movement (κίνησις), and there are two types of movement--continuous (συνεχής) and discontinuous (διαστηματική). Continuous movement results in sound without specific pitches; it moves continually up and down in pitch and never rests; this is the type of sound man makes in speech. Intervallic movement results in music, for it has the capacity of stopping at a certain pitch; it can move up and down as could continuous movement, but only intervallic (=discontinuous) movement

can come to rest at one or more particular pitches. These stopping points (μοναί) have space between them, i.e. intervals (διαστήματα), and intervallic movement passes over these spaces. Another name for these stoppoing points is "pitches" or "tunings" (τάσεις).

What makes sound, whether diastematic or continuous, move up and down to make the various pitches or the various non-specific tones of speech, is tension (ἐπίτασις) and relaxation (ἄνεσις). Terms for the result of tension and relaxation are highness (ὀξύτης) and lowness (βαρύτης), respectively.

So far this acoustical analysis has little to do with music per se, but Cleonides (and the other musicologists) tells us next that these pitches can also be called "notes" (φθόγγοι). According to Cleonides, τάσεις are specifically notes produced by instruments, φθόγγοιthose produced by the human voice. (This fact should be kept in mind. Ptolemy and the Pythagoreans insist on constructing a precise musical canon in order to produce musical pitches. The Aristoxenians were satisfied to rely on the vox humana.)

Cleonides' discussion of φθόγγοι falls into three main sections. The first describes the acoustics of notes (2.11-3.11); the second describes the names of the eighteen notes in each of the three genera (3.12-7.15); the third treats "fixed" and "movable" notes (7.16-9.2). The second part itself falls into five sub-sections, for which see infra, n. 3.12.

2.12 συνεχής is used of "continuous" space as early as Parmenides (8.6.25) and frequently in Aristotle and Plato (LSJ I, a). Mathematicians then used the word to describe "consecutive" numbers; Aristoxenus was the first we know of to use the word in a musicological

context. He referred (67.3) to οἱ [φθόγγοι] συνεχεῖς, "notes in succession" when referring to contiguous notes in a scale, but he also referred (13.10), as does Cleonides, to συνεχὴς κίνησις. This phrase refers to sound which moves up and down in pitch without landing on distinguishable (musical) pitches, e.g. the sound of human conversation. (Aristoxenus' statement is perhaps evidence that the Greeks in c. 300 B.C. did not pronounce their accents in specific intervals such as a fourth or fifth.) The opposite of this continuous movement is διαστηματική or "intervallic" movement. Like συνεχής, διαστηματικός is an often used technical musicological term. It can be found in Archytas I as well as in the parallel passages cited above. The word also had mathematical connotations (LSJ III), though these apparently postdate the musical usage of Aristoxenus.

κίνησις, apart from συνεχής or διαστηματικός can be a musicological term on its own. Aristoxenus (7.9) says κατὰ τόπον κίνησις τῆς φωνῆς, when referring to changing the locus of a voice. Otherwise κίνησις is used by musicologists only in connnection with the continuous and intervallic movement of sound. [Ptolemy] (413) describes melodic (=intervallic) motion as χρῆσις διαστηματικῆς κεκλασμένης ("broken") φωνῆς.

κίνησις can also refer to many types of "movement" unrelated to musicology--political, military, legal--but it also is employed in dance terminology, e.gg. Tyrt. 16 and Luc. Salt. 63.

λογική is an adjective meaning here simply "of speech" or "for speaking." Cleonides offers the antonym μελῳδική, but Dionysius of Halicarnassus (Comp. Verb. 11) offers μουσική as the antonym. Elsewhere λογικός can refer more specifically to prose, to reason and in-

tellect, or dialectical argument, but the λογική found in Cleoindes, Aristoxenus (15.41 14.12), Aristides (54.22), and Gaudentius (328.3) has no philosophical connotations; it refers only to speech in the mundane, physical sense.

μελῳδική, on the other hand, is an adjectival variant of the word μέλος, which is a word extremely essential to Greek music (but much less essential for Greek musicology). It can be found in Aristides, Aristoxenus, and Bryennius in a dozen passages, and once in Ptolemy, but for the most part Greek musicologists are much less interested in melody or tunes than they are in harmonics and philosophy. Cleonides uses μέλος only at 11.10 and 29.3. Bacchius (#78) defines μέλος as τὸ ἒκ φθόγγων καὶ διαστημάτων καὶ χρόνων συγκείμενον. The lyric poets use μέλος as the "melody" of an instrument, e.g. Pi. P. 12.19; originally, of course, μέλος meant "limb, member," and from this it came to mean "limb" or "strain" of a song. μελῳδική seems to be the accepted adjective for μέλος.

2.12-13 For λογική and μελῳδική Strunk translates "belongs to speech" and "belongs to melody"; Davy, "that which we use in common speaking or discourse" and "as applied to song"; Ruelle, "de la parole" and "musical"; Forcadel, "sermocinal" and "à bien chanter" (cf. Pena, "sermocinalis" and "ad bene canendum accomodatus"); Meibom (and Gregorius), "quo sermocinantes utimur" and "in modulationibus adhibemus"; Menge, "loquendi proprius" and "melodicus." The English word which comes closest to being an adjective referring to something pertaining to speech is "spoken." For συνεχής all have the appropriate form of continuous; for διαστηματική, Strunk and Davy have "diastematic, and Ruelle "discontinu." There are merits to Sturnk's and Davy's "diaste-

matic" in that it preserves the Greek word, but since the very common term διάστημα must be translated as "interval," it is better to translate διαστηματική as "intervallic." Ruelle's "discontinu" is useful in that it aids in distinguishing "continuous" and "discontinuous" movements, yet even Cleonides did not think it necessary to make διαστηματική a variant form of συνεχής.

2.15 ἀφανεῖς (Q) fits the sentence syntactically and grammatically, but its origin is no doubt as an error by attraction. ἀφανῶς is correct.

ἄνεσις and ἐπίτασις are the accepted musicological terms for "loosening" and "tightening" a string. A tighter string produces a higher sound, a looser string a lower sound. Metaphorically, however, both words could be applied to the raising or lowering of sounds not string-produced, i.e. sounds of the voice or aulos. Outside of musicological writings ἐπίτασις is found in connection with medicine (Thphr. Fr. 172.2), and [Longinus] (38.6) uses it to describe "exaggeration." Philodemus (PO2.18) uses ἐπίτασις with its opposite ἄνεσις in connection with the pitch accent, ἐπίτασις referring to the presence of accent, ἄνεσις to its absence. ἄνεσις has still other appearances outside of musicology, e.gg. Hdt. 5.28 uses it politically, Pl. Leg. 724 A uses it to mean "relaxation, recreation," and Pl. Rep. 561 A uses it to mean indulgence. For its use in other musicologists, see Bacchius #19, 45; Aristoxenus 15.13, 20-21; Aristides 6.1, 29; 28.5, 6; [Arist.] 19.3; Nicomachus 248.11; Gaudentius 328.23-24; and Bryennius 86.5-7. See also Michaelides, "epitasis," 107-108 and "anesis," 18-19. Strunk translates the terms here as "tensions" and "relaxations," Ruelle "les surtensions et les relâchements," Meibom and Menge "intensiones quam remissiones."

2.17 μονή is a rather common word meaning simply "delay, abiding, tarrying" (Eur. HF 957; Xen. An. 5.1.5). Aristotle (Ph. $205^{a}17$) observes that its general physical opposite is κίνησις, and this is true in musicology although none of our extant sources say so in so many words. Polybius (4.14.4) uses the phrase μὴ λαμβάνειν μονὴν μηδὲ στάσιν, and, curiously, Aristoxenus (17.3-4) has the same two words linked, μονή τις καὶ στάσις τῆς φωνῆς. Cleonides will use μονή again at 29.5 in defining one the melopoiic forms, τονή; Bacchius (#45) labels essentially the same phenomenon as μονή. See also Aristides 6.7, 28; Nicomachus 243.1; Gaudentius 329.8 (who also has τάσις δὲ μονὴ καὶ στάσις τῆς φωνῆς).

διάστασις is elsewhere a common word used only rarely musicologically. Cleonides uses the general term διαστάσεις here to describe a musical interval because he has not yet arrived at the point in his discussion where he can formally present the musicological term διάστημα. This he does in the next sentence.

2.19-20 The subject of ποιεῖ is διαστηματικὴ κίνησις, so τιθεῖσα is the preferable reading. It is a feminine singular nominative participle agreeing with κίνησις, and a finite verb such as τιθεῖται(U, =τιθῆται? τίθεται?) or τέθειται(S--Jan's reading of τεθ- in L is incorrect) would necessitate the addition of another connective after ἐναλλάξ.

The addition of διαστάσεις after τὰς δὲ resulted from a gloss intrusion--probably from the type of marginal notes described above. διαστάσεις is the very word Cleonides uses in 2.18 where he establishes the difference between resting points (μονάς) and intervals (διαστάσεις). It would therefore be more desirable to read τὰς δὲ διαστάσεις (or rather: διαστάσεις δὲ τὰς) μεταβάσεις τὰς ἀπὸ τάσεων ἐπὶ

τάσεις. τὰ δὲ ποιοῦντα τὴν τῶν τάσεων διαφορὰν ἐπίτασίς ἐστι καὶ ἄνεσις, ἀποτέλεσμα δὲ τούτων ὀξύτης καὶ βαρύτης, but the surviving manuscript tradition just does not allow for this. It would necessitate blending a clearly divided traditin, taking the readings of U in the first half of the sentence (διαστάσεις), and then taking the readings of MCP in the second half (τὰ δὲ ποιοῦντα). U's reading here cannot stand on its own; to have the definition of διαστήματα here again in apposition to τὴν τῶν τάσεων διαφοράν would be otiose.

For τάσεις, see supra, 1.10. τάσις is clearly the musicologists' term (cf. καλοῦμεν) for these certain μονὰς; that is, they do not call them "stopping places" but "tunings" or "pitches."

μεταβαόεις, not a musicological term, serves as a parallel to διαστάσεις. διαστάσεις was the layman's term for "interval" which Cleonides employed until he was ready to define (and employ) διάστημα; similarly, Cleonides used μονὰς until he was ready to define τάσεις. Now Cleonides uses the general, layman's term μεταβάσις("shifting, transition") to substitute again for διαστηματικὴ κίνησις and the resulting διάστημα.

3.1-2 The same tradition that read the previous sentence incorrectly (Z), now continues the error, suggesting that the tightening and loosening of strings is the result of high and low intervals; the correct process is the reverse.

ἀποτελέσματα (P) reflects the plurality of ὀξύτης καὶ βαρύτης, but it is not necessary to make the word plural. The omission of καὶ in U is possible Greek, but unlike the style of Cleonides; he offers no other examples of a couplet joined merely by punctuation instead of by a connective. The word ἀποτέλεσμα is not a technical term for musicolo-

gists. It is found only in Aristides 4.26 and Bryennius 86.29f. (the parallel to Cleonides' passage).

3.3-6 Cleonides now supplies a sentence introduced by γάρ to clarify his preceding remarks. He does not repeat himself. Thus far he has made clear only that1) tightening and loosening make the intervals (τὴν τῶν τάσεων διαφοραν), and that 2) tightening and loosening produce high and low sounds (ὀξύτης καὶ βαρύτης). Now Cleonides makes the next step more specific: tightening in particular creates higher sounds, while loosening produces lower sounds. In the next sentence, however, ὀξύτης μὲν οὖν ἐστι τὸ δι' ἐπιτάσεως γινόμενον ἀποτέλεσμα, βαρύτης δὲ τὸ δι' ἀνέσεως, Cleonides does seem to repeat himself. He has just said the exact same thing; the only difference is that in the first sentence he "produced" (ἄγει) high and low sounds, while in the second sentence the high and low sounds are accomplished results (ἀποτέλεσμα). The distinction is not great, but it is probably great enough to regard the second sentence as Cleonides' own rather than as a later reader's annotation which has crept into the text. Clearly, ἀποτέλεσμα has a significant meaning for Cleonides while it is not used by the other musicologists; for him it refers to the produced sound, the actual pitches sung or played, as opposed to sounds and pitches being formed by lowering or raising the voice or by tightening or loosening strings. ἀποτέλεσμα is the end, not the means or the process. Cleonides' quasi-technical use of the word may reveal some Stoic training; (cf. its meaning as an "effect" opposite to αἰτία ("cause") in Stoic. 2.118).

Jan is quite correct in attributing the reading in Z (his W) here to a gloss intrusion; the gloss was ὀξύτητος καὶ βαρύτητος διάφερον.

The introduction to the next sentence (3.4) has many manuscript variants. ὀξύτης is clearly inadequate; even the second half of the sentence adds δὲ after βαρύτης. Cleonides normally uses a form of εἶναι when called for, but he can omit it in the second half of a compound sentence. As a result the verb factor should not affect the other four readings. μὲν οὖν is a compound particle, and adding καὶ before it makes the phrase even more compounded. Cleonides uses μὲν οὖν frequently, always to introduce a series of definitions. More often than not, this "series" consists of only one pair of definitions. In these cases, the first definition begins with μὲν οὖν, the second with simple δὲ. Examples can be found at 2.13/14; 2.19; 7.17; 8.3; 8.9; 8.14 (οὖν οἱ μὲν); 9.6; 9.14; 9.17; 10.5; 11.4; 11.12; 11.21; 12.9; 14.6; 14.9; 15.9; 17.8; 17.15; 23.16; 24.8; 27.2; 27.16; and 29.2. Not once in these twenty-four examples does Cleonides add a preceding καὶ. The μὲν οὖν certainly does fit the passage in question, however, and so the emendation in Q seems to be the most reliable text; cf. infra, n. 4.4.

The addition after βαρύτητα by C^2-- βαρύτης μέν ἐστι τὸ δι' ἀνέσεως γινόμενον ἀποτέλεσμα-- resulted from the omission of βαρύτης δὲ τὸ δι' ἀνέσεως below in 3.5-6. The omission by MC (M^1 corrects the omission in the margin) was an unfortunate error. It cannot reflect Cleonides' original text; he completes his parallel statements elsewhere in the treatise. The cause for the omission is difficult to spot, unless originally Cleonides' words were βαρύτης δὲ τὸ δι' ἀνέσεως γινόμενον ἀποτέλεσμα. Such a homoeoteleuton would easily explain the omission, but our extant manuscripts do not preserve such a reading.

Jan placed brackets and elipses at and around [...ἀμφοῖν γὰρ

συμβέβηκε τὸ τετάσθαι], and Strunk felt compelled to move the sentence to after ἐνεργοῦνται in 3.9. Neither editorial whim should be granted license. From the initial statements about movement affecting the quality of sound (ἐν φωνῆς ποιότητι, ἧς κινήσεις εἰσὶ δύο), Cleonides has developed his acoustical essay through continuous and discontinuous movements to the high and low pitches produced from tension and relaxation. But the tension and relaxation of what? How does one physically manipulate pitch and tension? The answers lie, logically, in the next sentence-- ἀμφοῖν γὰρ συμβέβηκε τὸ τετάσθαι. The answer is that tension and relaxation are the properties of the sound-producing implement, in this case, a stretched chord or string. Tension and relaxation both (ἀμφοῖν) have(συμβέβηκε) one common necessity--stretchability (and its requisite opposite), i.e. a stretched string (τὸ τετάσθαι).

3.7 Cleonides now differentiates two different methods of stretchability, i.e. a stringed instrument and the human voice (φωνή), and he does this to reach his ultimate goal: καλοῦνται δὲ τάσεις καὶ φθόγγοι. περὶ φθόγγων was his initial definition in 1.7, and now he has discussed it in detail, reserving, however, the actual term φθόγγος until after the explanation of its acoustical principles. Moving from the general to the particular, Cleonides delineated sound, narrowed this eventually to a physically musical τάσις, and now he further specifies a type of sound, the quintessentially musical φθόγγος. Since Cleonides has made this so clear, the αἱ which Z supplies before τάσεις to clarify τάσεις as subject of the sentence need not be printed (as did Jan). But it must be understood in sense. The sentence cannot be rendered, "they are called "pitches" and "notes," for "they" (ὀξύτης καὶ βαρύτης) are

neither pitches nor notes; they are only qualities of notes. The sentence must be rendered, "pitches are also called 'notes,'" for φθόγγος is a sub-species of τάσις. καὶ ("also") brings out this meaning. Cleonides has now reached the description which he had made in his earlier definition of φθόγγος (1.9): φθόγγος μὲν οὖν ἐστι πτῶσις ἐμμελὴς ἐπὶ μίαν τάσιν.

φθόγγος is the basic building block of Greek musicology, so Cleonides announces it as the first subject to be discussed and gives it more detailed exegesis than the other parts of harmonics. In fact, φθόγγος was needed in order to define ἁρμονική (1.5). The word appears in Homer (Il. 5.234) but only signifying a human voice (=φωνή). As early as Simonides (37.11) φθόγγος signified a general sound (φθόγγος ἀνέμων) , and this non-musical sense continues until Galen (15.6); see LSJ II.1. In a musical sense, unlike most musicological terms, φθόγγος has a traceable history before Aristoxenus. Euripides (El. 716) uses the phrase λωτὸς φθόγγον κελάδει. According to Cleonides, however, a flute's sound should be called τασις, and only human singing should produce a φθόγγος. Plato (Leg. 812 D) also refers to the φθόγγος λύρας. Despite the word's long history, no authors except the musicologists (or those later than they) refer to φθόγγοι as specific musical notes.

The loci paralleli which contain discussions about or brief mentions of φθόγγος are too abundant to be enumerated here. For general definitions, see supra, n. 1.9, Nicomachus #11, Aristides 1.6, Bryennius 1.4, Ptolemy 1.4, Theon 2, and Martianus Capella #939.

3.8 U reads καθ' αὐτῶν ; MC read καθαπτῶν; and SL read καθ' αὐτῶν. Because the similarity of pi (π) and upsilon is so great when written

in miniscule, καθαπτῶν could have easily been corrupted to καθ' αὐτῶν; breathing marks were also easy to confuse, the unaspirated mark often written as ᾽.

κατά plus the genitive generally means "down from" or "against." καθ' αὐτῶν could mean "from itself," but this phrase cannot apply to the sentence in question here. The error in writing καθ' αὐτῶν or καθ' αὐτῶν is a clear case of writing the lectio facilior; καθαπτός is a rare adjective, while κατά plus genitive is quite common. καθαπτός is found in Eur. Fr. 752 meaning "bound with, equipped with"; in its musical sense it was used by Aristocles (ap. Athen. 4.174 C) with no other word than ὄργανον; it means "percussion" and thus applies perfectly to Cleonides' sentence. φθόγγοι are produced by vocal chords, τάσεις are produced by percussion instruments, i.e. instruments that require plucking, most probably a cithara (or canon?).

This is one of Cleonides' few definitions which totally omit a form of εἶναι.

ὄργανον refers to a musical instrument, a rare harmonicist's mentioning of so mundane a musical tool. Greek musicologists, particularly the Aristoxenians, had little interest in instruments except in that they could produce musical sounds. Only Aristoxenus (41.10) mentions the study of ὀργανική, and he also wrote a (lost) treatise Περὶ ὀργάνων , for which see da Rios 95, n. 1.9. The later Aristoxenians not only had little interest in organology, they were hardly even interested in musical sounds since the bulk of their treatises delight only in musicological theory and organization. Moreover, it should again be mentioned that Cleonides limits φθόγγοι to sounds made by the human voice.

3.9 φωνή here means specifically "the human voice," as opposed to ὀργάνων.

3.10 N has here a scholion which refers to Bryennius 90.6.

Cleonides now makes clear two categories of φθόγγοι. The first includes an unlimited number of vocal notes; any mathematically possible resting point (τάσις) can become a note, and so the number of notes is literally infinite. The second includes a specific number of vocal notes--only those eighteen functional notes which belong in each genus. Which notes these are, and what the genera are, Cleonides will explain in his next passage.

τάσις here simply means "pitch." For δύναμις ("function") and its musicological meaning, see <u>infra</u>, 23.16 and 29.10. Basically, δύναμις refers to the relationship of a note to the notes surrounding it. A note can actually exist at an infinite number of pitches, but there are only a limited number (eighteen) of functions which a note can have in Greek musicology, no matter on which of the infinite pitches it is located. The introductory sentences of any technical treatise always run the risk of confusing the reader with their multiplicity of definitions and unexplained technical terms, but once the treatise is read in its entirety these earlier definitions become clearer and more useful.

3.12-15 Cleonides begins here the second section of his discussion of φθόγγοι. This second section falls into two main sub-sections. The first (3.12-4.3) seems to be an intrusion, for it injects into the note-discussion a brief digression of genus. But the reader should not understand this brief passage to be Cleonides' discussion of genus. That will follow the discussion of intervals (11.9). At the moment, Cleonides feels a need to introduce the genera so that he can expose his

reader to the names of the eighteen notes in each genus. If the reader has no idea what a genus is, he will not understand the different terminologies employed for naming the various notes. Cleonides probably could have eliminated this brief passage on genus, for it may well have seemed confusing to one who was learning about notes for the first time; such a novice was not, however, Cleonides' intended reader.

At least Cleonides does not bombard the reader with generic information; he simply names the three genera and then describes the sequence of intervals within each, both ascending and descending. Cleonides only mention these three genera here, though at 6.11 he will name a virtual fourth, i.e. the mixture of the other three (κατὰ μίξιν); the mixed genus is not necessary for the first three list all the possible notes. It is probably coincidence, or more likely tradition, but Cleonides lists the three genera in the order of their historical development. The diatonic was oldest, the chromatic next ([Plut.] 1137 E)), and the enharmonic last--developed by Olympus, according to Aristoxenus.

In describing the sequence of intervals in each genus, Cleonides becomes quite formulaic; he lists the descending intervals and then the ascending with absolutely no elaboration or variation of format. But there is no need for elaboration here; he deals with a formulaic matter. Aristides (16.4-10) lists the genera in the same formulaic ascending and descending manner, though in the reverse order (enharmonic, chromatic, diatonic, instead of diatonic, chromatic, enharmonic). The same is true for Bacchius (#22-24) and Gaudentius (331.15-23).

The construction of the diatonic genus is this:

descending: tone plus tone plus halftone (1 + 1 + ½)

ascending: halftone plus tone plus tone (½ + 1 + 1)

of the chromatic genus:

descending: trihemitone plus halftone plus halftone

(1½ + ½ + ½)

ascending: halftone plus halftone plus trihemitone

(½ + ½ + 1½)

and of the enharmonic genus:

descending: ditone plus quartertone plus quartertone

(2 + ¼ + ¼)

ascending: quartertone plus quartertone plus ditone

(¼ + ¼ + 2)

The ditone is the equivalent of two whole tones, the trihemitone of one and one-half whole tones.

The second sub-section lasts from 4.4 to 7.15; it introduces the reader to the names of the eighteen notes in each genus.

γένος is an old, widely used word found in all ages and genres of Greek literature. Originally derived from the root for "birth," γένος first came to mean "race," and eventually this idea developed into "kind, type, class." In this sense Aristotle and Plato used it in opposition to εἶδος ("species"). Aristotle and the Peripatetics used the word in biological classifications, and the musicologists borrowed the word to describe musical classifictions.

The variant form for διάτονον, διατονικόν, is not used interchangeably nor is it used as frequently. It can be found in Aristides (11.4) and here at 9.11, 10.11, 14.5, and 15.12. διάτονος derives from διατείνω (cf. τάσις, τόνος, ἐπίτασις). Theophrastus uses it in connection with αὖραι ("stretching winds" CP 2.31), and Vitruvius (2.8.7)

uses it in connection with courses "stretching" along a wall. But it is in music that the word finds its most frequent usage. The adjective διάτονον (sc. γένος) is usually employed without the accompanying noun; other than musicologists, Alciphro (1.8--fourth century A.D.) uses the word with μέλος, and Dionysius of Halicarnassus (Comp. Verb. 19) with μελῳδία.

Unlike the adjective διάτονον, χρῶμα is a noun; χρωματικόν (sc. γενος) is the adjective, and again γένος is usually omitted. χρῶμα originally meant "skin," and from here it took on meanings connected with that which is associated with the skin, e.g. color, complexion, or character. From "color" came the idea of literary "color" or ornament (Pl. Rep. 601 B), and in music the word meant "ornament" or "modification" as early as the fourth century B.C. As a genus or modification of the tetrachord we find examples in all the musicologists. The Aristoxenians divide the chromatic genus into three shades, for which see infra, 12.6f and PHib. 1, 13, 22 (Anon.).

The ἐναρμόνιον (sc. γένος)--ἁρμονία being the noun--originally meant "in harmony," and so when Plato (Leg. 654 A) uses it--ἔνρυθμος καὶ ἐναρμόνιος αἴσθησις--he refers not to an analytical genus of music but to its tuneful quality. All the musicologists use the word as a generic name, even POxy. 667.1. For ἁρμονία, see supra, n. 1.3.

3.13-14 μελῳδέω in the active can mean "to chant, sing" (Ar. Av. 226), but in the passive it can also mean simply "to be set to music" (Cleanth. ap. Philodemus de Mus. p. 98 (Kemke), [Plut.] 2.1019 A). See also Cleonides 14.19, 21.9, 15, 16; 29.8-9; [Arist.] 19.18, Bacchius #5, 7; Gaudentius 330.23, 25; [Ptol.] 413.8; and more frequently in Aristides,

Aristoxenus, and Bryennius.

βαρύς and ὀξύς were contrasted as musical opposites as early as Plato (Phaedr. 268 E). The phrases ἐπὶ τὸ βαρύ and ἐπὶ τὸ ὀξύ are very common to Greek musicological writings, e.gg. [Arist.] 33.4-5(Jan), Gaudentius #5, Bacchius #22-25. The phrases mean "descending" and "ascending," respectively. Aristides (16.9) varies the phrase with ἐπὶ τὴν βαρύτητα.

The insertion of the direct article (P) is unnecessary; cf. 3.16 κατὰ τριημιτόνιον and 3.17 κατὰ ἡμιτόνιον.

4.4 Here Cleonides begins a new sub-division of this discussion on genus. Without further discussion of terms, i.e. names of the tetrachords or musical relationships, he simply lists the eighteen notes in each of the diatonic, chromatic, and enharmonic genera and then the twenty-eight notes in the mixed" genera. A similar listing of notes can be found in Aristides 7.18-8.2, Nicomachus 264.8, Ptolemy 1.4, Bacchius #13 (M only), Gaudentius 336.8-14, Alypius passim, and Bryennius 70.18-27. Cleonides lists the notes in both the greater and lesser perfect systems, and he inserts the conjunct (synemmenon) tetrachord between mese and paramese.

Parallels for the readings in MC--εἰσιν οἱ μεν ἑν--are not to be found in the treatise. While 9.19 (ἔστι δὲ συμφωνία μὲν) and 18.6, 11, 16, 18 (all ἔστι δὲ) suggest that the reading in P may well be original with Cleonides, these passages do not, however, parallel exactly the construction here which begins with a list. The two sentences in the treatise which parallel the construction here and begin lists are at 7.22 (εἰσὶν οὖν οἱ μὲν) and 8.14 (εἰσὶν οὖν οἱ μὲν), and these are not echoed exactly by the reading in Q. Q, apparently, has made a suc-

cessful emendation. C's γένει is a gloss intrusion; cf. 5.1 and 5.20.

4.5 Many manuscripts make omissions throughout these lists, often with corrections (or errors) or variant readings added in the margins. The reason for these frequent omissions is that the lists repeat many words, e.gg. συνημμένων, νήτη, διάστονος, and this induces omission. In addition, another part of the tradition (U) confused the punctuation in these lists, and many words were placed in the wrong line. Such a transferal caused (non-existing) notes to be named "paramese synemmenon"(4.16 U).

The manuscripts do not arrange these notes in list form; they all give the notes in paragraph form, with the exception of S. Jan presents them in list form (from Vat. Reg. 169) and I follow him with modifications.

For the meaning and origin of the names of the notes, see Aristides 8.3-9.12.

4.22 Jan prints a staff of music alongside this list of notes in the diatonic genus. He shows the two octaves from A to á (proslambanomenos to nete hyperbolaion), making all the fixed notes halfnotes except for proslambanomenos and nete hyperbolaion, which are whole notes, and making all the movable notes quarternotes. His schematization is rhythmically absurd, but pedagogically, visually, and tonally instructive; my schematizations will follow his format. For further clarification one might make clear the intervals between the individual notes and make the tetrachordal structure more plain. Jan does not include a staff of music for the other two genera.

Here is a schematization of the diatonic genus:

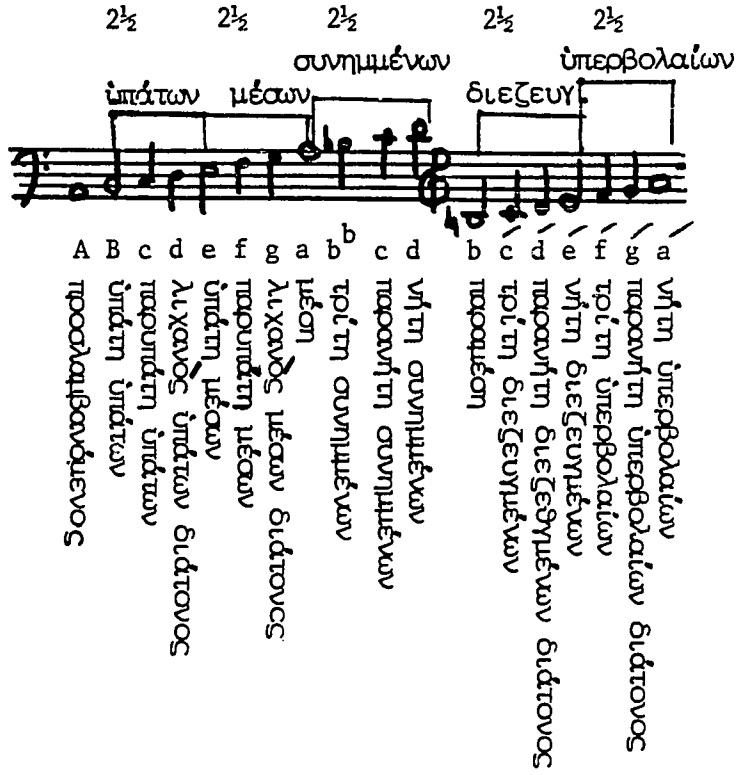
tet. size

tet. name

modern notation

modern name

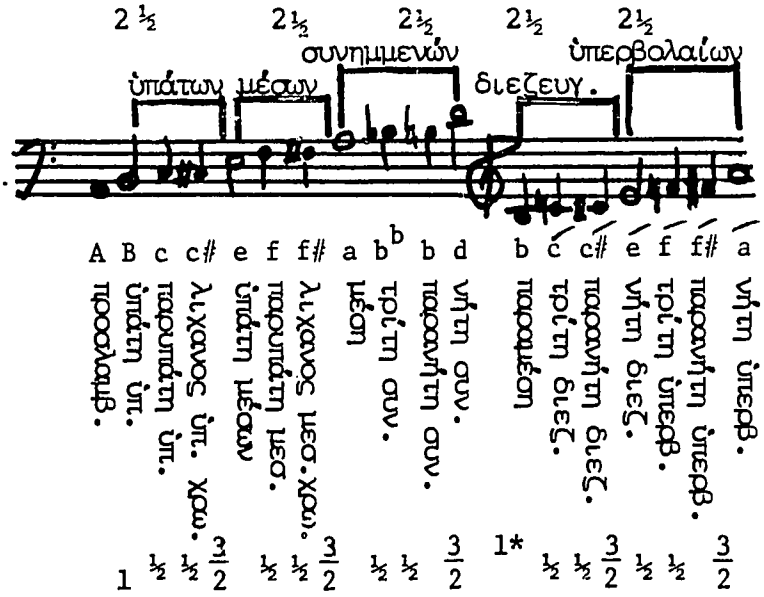
Greek name



interval 1 ½ 1 1 ½ 1 1 ½ 1 1 1* ½ 1 1 ½ 1 1

* one whole tone from mese

5.19 The chromatic genus:



*one whole tone from mese

5.20 ἁρμονία is interchangeable with ἐναρμόνιον; cf. supra, n. 3.12.

6.1 The addition of ἐναρμόνιος in 6.1, 6.5, and 6.8 by MC (and printed by Jan) is not correct. In defense of Jan one cannot deny that these three notes--trite synemmenon, trite diezeugmenon, and trite hyperbolaion--are different notes in the diatonic, chromatic, and enharmonic genera. The third note ascending--lichanos and paranete--varies with each genus. If Cleonides had actually written ἐναρμόνιος after these three notes, why did he not also add them to the lower notes of the two-octave enharmonic genus--parhypate hypaton and parhypate meson? These notes are as different from their diatonic and chromatic counterparts as are trite synemmenon, trite diezeugmenon, and trite hyperbolaion, and yet not one manuscript reads παρανήτη ὑπάτων ἐναρμόνιος or παρυπάτη μέσων ἐναρμόνιος. In addition, in the next passage which lists the mixed genera there is no enharmonic qualification for trite synemmenon, trite diezeugmenon, or trite hyperbolaion (nor for parhypate hypaton or parhypate meson).

The enharmonic genus:

*one whole tone from mese

6.11 Earlier (3.12) Cleonides listed the three genera--diatonic, chromatic, and enharmonic. Here he does not really present a fourth genus, but a mixture of the genera (μίξιν τῶν γενῶν); cf. also 11.9 (μέλος μικτόν) and Aristoxenus 11.17, Aristides 29.2, 5-7, and Bryennius 326.11f. All of these passages refer to different forms of μίξις. No other extant Aristoxenian musicological treatise lists the blended notes of the genera in this way. Nicomachus (264) does so, as does Boethius (1.22). Only Boethius emphasizes the fact that there are twenty-eight notes in all; yet perhaps it was understood that twenty-eight was a "perfect" number and equal to the sum of all its divisors (e.g. 1, 2, 4, 7, 14).

In light of the variant readings at 6.1, 5, and 8, Cleonides (or a later reader) might have opted to add ἐναρμόνιος after the parhypate hypaton, parhypate meson, and the three trite's, for the pitch of parhypate hypaton in the enharmonic genus differs from the pitch of parhypate hypaton in the chromatic and diatonic genera. A clearer list would have read: προσλαμβανόμενος, ὑπάτη ὑπάτων, παρυπάτη ὑπάτων ἐναρμόνιος, παρυπάτη ὑπάτων χρωματικὴ καὶ διάτονος, λιχανὸς ὑπάτων ἐναρμόνιος, λιχανὸς κ.τ.λ. If this second parhypate and trite are not added for the enharmonic genus in order to differentiate pitches, then why include three types of lichanoi or paranetai?

The mixture of the genera is schematized on the following page:

\a νήτη ὑπερβολαίων
\g παρανήτη ὑπερβολαίων διάτονος
\f# παρανήτη ὑπερβολαίων χρωματική
\f παρανήτη ὑπερβ. έναρμ./ τρίτη ὑπ. δια., χρω.
\e* τριτη ὑπερβ. έναρμ.
\e νήτη διεζευγμένων
\d παρανήτη διεζ. διάτονος
\c# παρανήτη διεζ. χρωματική
\c παρανήτη διεζ. έν./ τρίτη διεζ. δια., χρω.
b* τρίτη διεζ. έναρμ.
b παραμέση

ὑπερβολαίων

διεζευγμένων

d νήτη συνημμένων
c παρανήτη συν. διάτονος
b παρανήτη συν. χρωματική
b♭ παρανήτη συν. έναρμ./ τρίτη συν. δια., χρω.
a* τρίτη συνημμένων έναρμ.
a μέση
g λιχανὸς μέσων διάτονος
f# λιχανὸς μέσων χρωματική
f λιχανὸς μέσων έναρμ./ παρυπάτη μεσ. δια., χρω.
e* παρυπάτη μέσων έναρμ.
e ὑπάτη μέσων
d λιχανὸς ὑπάτων διάτονος
c# λιχανὸς ὑπάτων χρωματική
c λιχανὸς ὑπ. έναρμ./ παρυπάτη ὑπ. δια., χρω.
B* παρυπάτη ὑπάτων έναρμόνιος
B παρυπάτη ὑπάτων
A προσλαμβανόμενος

συνημμένων

μέσων

ὑπάτων

7.15 Q adds a passage from Aristides (8.9-9.12). This is the passage cited above as a parallel; it explains the relationships and names of all the eighteen notes--something which Cleonides neglects to do.

7.16-9.2 Cleonides now begins the third section of his discussion on φθόγγοι. He has up until this point described the acoustical properties of notes, described the tonal makeup of each genus, and then listed the eighteen notes in each genus and the twenty-eight notes in a combination of the genera. With the names and locations of all the notes now established, Cleonides can begin to specify their functions. This section of the discussion falls itself into sub-divisions. First Cleonides differentitates between "fixed" (ἑστῶτες) and "movable" (κινούμενοι) notes (7.16-7.25); second he differentiates the fixed notes into βαρύπυκνοι and ἄπυκνοι (8.1-8.7); third he differentiates the movable notes into μεσόπυκνοι, ὀξύπυκνοι, and diatonic (8.8-9.2. At the completion of this section Cleonides will have named and defined the relative function of each note in the greater and lesser perfect systems, even though he still has not yet informed the reader of multiple tetrachordal constructions. For other authors on fixed and movable notes, see Nicomachus 263.10-17, Aristoxenus 28.11-29.8 and 76.10-77.10, Alypius #4, Bacchius #35-36, Aristides 9.13-10.15, and Bryennius 90.8-27.

7.16-22 Returning to a more fluid, prose format, Cleonides first distinguishes two types of all the aforementioned (ἐξηριθμημένων) notes. "Fixed" (ἑστῶτες) notes do not share in the differences between genera, that is, they do not change pitch in one genus or another. They always remain constant and on the same pitch. "Movable" (κινούμενοι

notes are the opposite (τοὐνάντιον) in that they vary between genera and actually change pitch from one genus to another. For example, hypate hypaton is a fixed note; lichanos hypaton is movable. In the diatonic genus these notes should be located, according to the schematization on p. 220, on B and c, respectively. In the enharmonic genus the movable note lichanos hypaton takes on a different pitch while the fixed note hypate hypaton remains the same, i.e. C and B* (B plus one quartertone sharp), according to the schematization on p. 221. Lichanos hypaton is movable, and it "moves" in all three genera, being d in diatonic, c# in chromatic, and c in enharmonic. Cleonides lists the eight fixed notes; these are all the halfnotes and whole notes shown on the previous schematizations.

ἐξαριθμέω means simply "to enumerate, count," and it conceals no peculiar meaning for musicologists of antiquity. Cf., e.gg. Aristoxenus 10.19 and Bryennius 126.18.

ἑστῶτες is the intransitive perfect participle of ἵστημι; this verb, like κινέω, has many non-technical uses throughout Greek literature. The rationale behind these therms which describe fixed, i.e. "standing" and "moving" notes is not hard to discover. Both ἑστῶτες and κινούμενοι are technical terms which can be found used by every musicologist.

μεταπίπτω is a reasonably common word in the fifth and fourth centuries B.C. Aristotle (Mete. $360^{b}18$) uses it to mean "to migrate, be transferred," and "to change for the worse" in Po. $1453^{a}2$. μεταπίπτω does not seem to be a technical term for the peripatetics, but it does almost always contain the idea of moving or changing. With this implication the μεταπίπτω in Cleonides' sentence has a clearer meaning:

"fixed notes do not change or move their position in the differences between genera." πεπόνθασιν (from πάσχω) does not imply such movement or change though it does suggest that the movable notes undergo some actions, which would be "change."

7.17 μὲν οὖν is the compound particle with which Cleonides regularly begins a differentiation between two or more terms or categories. Cf. supra, n. 3.4.

The scholion from Aristides (N)--οἵτε ἄπυκνοι καὶ οἱ βαρύπυκνοι--is ahead of Cleonides, for he will define these terms at 8.1-2.

7.25 The οἵδε of UL is superfluous, although superfluity does not in any way automatically eliminate a reading as unauthentic. In a sentence which is somewhat parallel, 7.22: εἰσὶν οὖν οἱ μὲν ἑστῶτες ὁπτὼ οἵδε, Cleonides uses οἵδε, but here it introduces a list of notes. κινούμενοι δὲ οἱ ἀνὰ μέσον τούτων πάντες (7.25) does not do this, nor does this sentence define the movable notes, for Cleonides has performed that service already in 7.19-21. Cleonides does not trouble to list the movable notes as a group; only later will he list the individual types of movable notes (8.8 and 8.12).

If ἀνά took the genitive, one might opt for ἀνὰ μέσων since it could make more sense to say "along the middles" than "in the middle," which can be misleading. There are several movable notes in different spots, not just one or a group of them in the middle of the greater perfect system. We would, however, be making the phrase clearer than Cleonides did. Also, ἀνά plus accusative can be used distributively (LSJ III) and need not imply only one location (LSJ L.1, 2). Moreover, ἀνά plus genitive is very rare, occurring but three

times in the Odyssey and in several inscriptions.

Cleonides saw no need to list all the movable notes in one collection; his intention here is not to list or define the movable notes, but to help locate the fixed notes which are under discussion. For the sake of completeness, the ten movable notes are these: parhypate hypaton, lichanos hypaton, parhypate meson, lichanos meson, trite synemmenon, paranete synemmenon, trite diezeugmenon, paranete diezeugmenon, trite hyperbolaion, and paranete hyperbolaion. These notes are all schematized as quarternotes on p. 220.

8.1-7 In this second part of the discussion of fixed and movable notes, Cleonides divides the fixed notes into two sub-divisions--βαρύπυκνοι and ἄπυκνοι. βαρύπυκνοι are those fixed notes which are situated at the lowest point of a tetrachord; there are five of these since there are five tetrachords, and they are hypate hypaton, hypate meson, mese, paramese, and nete diezeugmenon. The bottom two barypyknoi are, in fact, labeled as "lowest" (ὑπάτη), but the higher three are not. ἄπυκνοι are those fixed notes which do not participate at all in the pyknon. Unfortunately, Cleonides has not yet explained what a "pyknon" is; he will do so at no point in the treatise. But we know from elsewhere, e.g. Bacchius #20, that "pyknon" refers to the two lower (and smaller) intervals in each genus (and in each tetrachord). The pyknon in the chromatic and enharmonic genera include the lower two intervals (three notes). There is, however, no pyknon in the diatonic genus (½ + 1 + 1) since its second interval (1) is not smaller than the third(1), nor is the combination of the first two intervals (½ + 1) smaller than the third (1). In the chromatic genus the sum of the first

two intervals (½ + ½) is smaller than the third interval (1½); this is also true in the enharmonic genus (¼ + ¼) is smaller than 2). There is no pyknon in the diatonic genus, and so technically the lowest note of a diatonic tetrachord should not be labeled βαρύπυκνος.

Equipped with this knowledge one can better understand Cleonides' terms. Barypyknoi are the lowest notes of the pykna, i.e. the lowest notes of the tetrachord as listed above. Apyknoi are notes which do not participate in the pykna; of the eighteen notes Cleonides has already presented, only three fit this description: proslambanomenos, which is part of no tetrachord; nete synemmenon, which is the highest note of the lesser perfect system, and nete hyperbolaion, which is the highest note of the greater perfect system.

Again Cleonides is ahead of himself by mentioning those notes περιέχοντες τὰ τέλεια συστήματα. There are two perfect systems, the lesser and the greater. The highest note in the lesser perfect system is nete synemmenon, the highest in the greater perfect system is nete hyperbolaion. Neither of these notes participates in a pyknon, and both "bound" their respective systems (at the top). Cleonides is not differentiating ἄπυκνοι and περιέχοντες τὰ τέλεια συστήματα; all three of the notes cited here do not participate in a pyknon and serve as the boundaries of their respective systems. For more on the perfect systems, see infra, 22.10-23.13. For the present, Cleonides' reader would benefit by knowing that the lists of generic notes which Cleonides has given in 4.5-7.15 are those found in the perfect systems.

For parallels on barypyknoi and apyknoi, see Bacchius #27, Alypius 368, Anonymous Bellermann #56, Pachymeres 391, and the aforementioned parallels for fixed and movable notes.

8.1 The scholion in N makes mention of Aristides' synonym for βαρύπυκνοι—ὑπατοειδεῖς. See Aristides 9.21: οἱ βαρύπυκνοι, οἱ καὶ ὑπατοειδεῖς καλοῦνται.

8.3 N has $\bar{\varepsilon}$ for πέντε, a type of abbreviation to be used frequently by many manuscripts in the latter parts of this treatise.

8.4 The scholion in N--ἤτοι ἐν τῷ συννημένων συστήματι. ἐν δὲ τῷ τελείῳ οὔ—at μέση is again ahead of the treatise. Cleonides has not yet differentiated the synemmenon (conjunct) system and the disjunct system.

8.6 Nete synemmenon and nete hyperbolaion are considered ἄπυκνοι; they sit atop their respective tetrachords, not at their bottoms, and therefore they may provide evidence, along with proslambanomenos, that the Greeks built their tetrachord from the bottom. This may be true even though the names such as "nete" and "paranete" belie this; cf. "hypate" and "parhypate." The top three tetrachords--synemmenon, diezeugmenon, and hyperbolaion--were constructed from the top; the bottom two tetrachords--hypaton and meson--from the bottom; highest--next highest--third and lichanos--second lowest--lowest.

8.8-9.2 Cleonides finishes his discussion of fixed and movable notes with a detailed list of the movable notes; at the same point he finishes his discussion of φθόγγος. While Cleonides does not say so, there are essentially two kinds of movable notes, those that are in pykna and those that are not. Those that are in pykna are found (by definition) in the chromatic and enharmonic genera; those that are not in pykna (by definition) are in the diatonic genus. Cleonides does not phrase his

passage in this way. He says that there are three types of movable notes--μεσόπυκνοι, ὀξύπυκνοι, διάτονοι.-- Mesopyknoi and oxypyknoi are similar to barypyknoi in that they belong to the pyknon; mesopyknoi are the second highest note in the pyknon, and the oxypyknoi are the third highest note. In the perfect systems there are five mesopyknoi, one for each tetrachord: parhypate hypaton, parhypate meson, trite synemmenon, trite diezeugmenon, and trite hyperbolaion. This is a general description, for there are actually two different mesopyknoi for the chromatic and enharmonic genera, e.g. the parhypate hypaton in the chromatic (refer to p. 220) is c, but the parhypate hypaton in the enharmonic is B*.

Similarly there are five oxypyknoi, five each in the chromatic and enharmonic: lichanos (hypaton and meson), and paranete (synemmenon, diezeugmenon, and hyperbolaion). Cleonides goes into greater detail here. He distinguishes enharmonic and chromatic mesopyknoi and lists them separately, adding ἐναρμόνιος or χρωματική after the tetrachord name. According to the tradition in CP(V), Cleonides added a list of diatonic notes as well, for which see infra, n. 8.22. The following diagram depicts the pykna and various parts of the pykna in two consecutive chromatic tetrachords, i.e. hypaton and meson.

chromatic genus

The following diagram shows the perfect systems and labels the fixed and movable notes, the apykno, barypyknoi, mesopyknoi, osypyknoi, and the diatonic notes; diatonic notes, of course, are not to be thought of as "mesopyknoi" and "oxypyknoi."

8.9 The addition here in Q--εἶτ' οὖν ἄπυκνοι preludes the idea to be presented at 8.14, that the diatonic notes--that is, the notes belonging to the diatonic genus--do not participate in the pyknon. Perhaps the phrase is borrowed from Aristides 9.15: οἱ δὲ μεσόπυκνοι, οἱ δὲ ὀξύπυκνοι, οἱ δὲ ἄπυκνοι.

8.10 The omnipresence of ὑπάτη ὑπάτων for παρυπάτη ὑπάτων in M^{ac}CP is disturbing. Parhypate hypaton is clearly the correct note; evidently our lost archetype began the trend by omitting the abbreviated παρ- from παρυπάτη.

8.11 It is disturbing that two of our better manuscripts (M^{ac}C) should have the reading τῶν ὑπερβολαίων for τρίτη ὑπερβολαίων. Similar to the error in 8.10, this misreading originated no doubt in the lost archetype, probably with an abbreviated τρίτη, occasionally written as gamma ($\overline{\Gamma}$) in the manuscripts.

8.12 The scholion here in N is a slightly paraphrased version of Aristides 9.16-20.

8.19 The omission in CP(VZ) of χρωματικὴ--διάτονος (alterum 8.23) is due to a homoeoteleuton.

8.21 Q appropriately inserts Aristides 9.15-10.15.

8.22 All the manuscripts with the exceptions of CP(VZS) omit any mention of the diatonic genus here. They follow Cleonides' own dogma established in 8.14: τὸ γὰρ διάτονον οὐ μετέχει πυκνοῦ. These manuscripts cease their discussion of movable notes (oxypyknoi) at 8.21 after paranete hyperbolaion chromatic, and they proceed directly to the

discussion of intervals (9.3). Q proceeds here to another insertion from Aristides (9.15-10.15). The four manuscripts which do mention the diatonic genus here start to list the oxypyknoi in the chromatic genus, λιχανὸς ὑπάτων χρωματικη, λιχανος μέσων, and then they skip abruptly to the diatonic notes διάτονος παρανήτη διεζευγμένων διάτονος, παρανήτη ὑπερβολαίων διάτονος; diatonic notes cannot qualify as examples of chromatic notes.

The only possible reading of the notes in the diatonic genus is then found in C^1P^1. In these groups all proceeds normally except at 8.22 where these manuscripts read ἐν δε τῷ διατόνῳ following the phraseology employed by Cleonides in introducing the chromatic (8.18: ἐν δὲ τῷ χρώματι οἵδε) and enharmonic (8.15: ἐν τῇ ἁρμονίᾳ οἵδε) oxypyknoi. Jan printed οἱ δὲ διάτονοι οἵδε, for which he had no manuscript support. His reason, given briefly in his apparatus, was, "Vide 186.14," that is, 8.14, the sentence which forbids diatonic entry into the pyknon. Musically he may well have a leg to stand on, but paleographically he does not. Any mention at all of the diatonic genus must begin ἐν δὲ τῷ διατόνῳ οἵδε and parallel the sentences introducing the chromatic and enharmonic oxypyknoi. Jan's phrase probably aimed at avoiding the connection between pykna and diatonic notes, but it fails to do so. Jan would apparently have liked at this point for the treatise to include some diatonic notes, but diatonic notes unrelated to pykna.

If one were to argue against the acceptance of this diatonic passage, he might argue in the following way. The discussion at hand since 8.1 has involved three types of movable notes--barypyknoi, mesopyknoi, and oxypyknoi. By including diatonic notes here the author can

suggest only one concept--that diatonic notes do belong in the pyknon. Cleonides has already made it quite clear that this concept is a musical impossibility. Therefore, this diatonic passage must have been added to the archetype of P^1C^1, and then it was corrupted in CP(SVZ). It should not be admitted as part of Cleonides' text. Such an argument probably resembled the logic behind Jan's rejection of ἐν δὲ τῷ διατόνῳ. (Jan conjectures οἱ δὲ διάτονοι in small letters; Menge places Jan's phrase in brackets.)

In opposition to the previous argument, the careful reader of Cleonides should be able to see that our author never says that diatonic notes participate in pykna. He made this quite clear at 8.14. Cleonides is not describing a diatonic type of oxypyknos. There is no such thing, and Cleonides cannot have forgotten that after just two intervening sentences. What Cleonides lists here is the third type of movable note; cf. 8.8-9: οἱ μέν εἰσι μεσόπυκνοι, οἱ δὲ ὀξύπυκνοι, οἱ δὲ διάτονοι. He first lists five mesopyknoi and does not bother to distinguish between chromatic and enharmonic genera, not to mention the diatonic. This is the same neglect in regard to parhypatai and tritai that Cleonides showed in listing the notes at supra, 6.13, 19, 24; 7.6, 11. These notes are equivalent in tetrachord position to mesopyknoi, and Cleonides does not differentitate between the various genera there or here. In listing the third highest note in the tetrachord Cleonides does indeed differentiate between genera. He does so at 6.15-17, 20-22; 7.1-3, 7-9, 12-14, and here. First he lists the enharmonic (8.15-18) and then the chromatic (8.19-21). Then he has finished with the oxypyknoi. But he still has one type of movable note to discuss--the five diatonic lichanoi and paranetai. These he

lists last at 8.22-9.2. If he introduced these notes with a phrase similar to that with which he introduced the chromatic and enharmonic oxypyknoi-- ἐν δὲ τῷ διατόνῳ οἵδε-he meant only to say that these five diatonic notes are found in the same relative position as the chromatic and enharmonic oxypyknoi, that is, three notes from the bottom of the tetrachord. (A similar confusion might be derived from the chart on p. 231.) Cleonides does not contradict himself;diatonic notes do not participate in the pykna. Lines 8.22-9.2 should be retained. They survive intact in C^1P^1, with severe corruption in CP(SVZ). In addition, the passage is introduced in 8.9: οἱ δὲ διάτονοί.

9.3-11.8 Cleonides discusses here the second of seven topics--interval (διάστημα). His definition of the term can be found at 1.9; here he described intervals in detail without troubling to repeat the definition. He discusses the five differences between intervals: in size, genus, consonance and dissonance, compositeness and non-compositeness, and rationality and irrationality. In the process he will name the major intervals and give the reader a clearer picture of the possibilities.

The discussion of intervals falls into six parts: 1) the introductory sentences announcing the five categories (9.2-6); 2) how intervals differ in size (9.6-10); 3) how intervals differ in genus (9.10-12); how intervals differ by being consonant or dissonant (9.12-10.2); 5) how intervals differ in being composite or non-composite (10.2-11.2); and 6) how intervals differ by being rational or irrational (11.2-11.8).

For parallels on intervals and the different types of inter-

vals, see Bryennius 1.5 (who also lists five types); Aristoxenus 21.17-22.3;(who also lists five types); Aristides 1.7; Theon 3; Martianus Capella #948-53; Anonymous Bellermann #22; 58; Nicomachus #12; Vincent 234; Jan 133 and Michaelides, "diastema" 77-78.

Though Cleonides clearly presents his meaning here, his syntax is not clearly preserved. All the manuscripts with the exception of Z (ἤ) omit any connective other than καὶ between the last three types of interval differences. Z inserts ἤ between these three phrases as well as between the previous two and the initial phrase Τῶν δὲ διαστημάτων διαφοραί εἰσι πέντε, ἤ τε μεγέθει, κ.τ.λ. The rest of the codices have ἤ instead of Z's initial ἤ , and they add another after τε μεγέθει ἀλλήλων διαφέρει καὶ and another after the ensuing κατὰ γένος καί. From elsewhere in the treatise Cleonides offers a parallel at 15.3-5, where, like 9.3, he introduces a new subject (systems) and its various sub-groups. Here he repeats the article ἡ. The multiple use of the conjunction ἤ (Z) has its parallel in 11.9-11, where Cleonides introduces a different subject (genus) and its sub-groups. The repetition of the relative found in the other manuscripts at 9.3f. is not without its parallels either, even in this paragraph (9.10): Ἡ δὲ κατὰ γένος, καθ' ἣν ἃ μέν κ.τ.λ., though here the relatives are accompanied by μὲν and δὲ. Jan reads a repetition of the article ἡ in W (=Vat. 191), which would work nicely, except that Jan's readings here were incorrect (with the exception of the initial ἤ after πέντε in 9.3). All the rest of W's connectives were, as we would expect, the same as those in Z (ἤ). S substitutes ἤτε for the first καὶ ἤ in 9.4, and so Pena and Meibom also printed this substitution.

Cleonides may well have written ἤ, for it works grammatically

and syntactically, and it could be considered to be the difficilior lectio. Still, in light of the parallels cited above, it is curious that Cleonides would use this for two of the five conjunctions and then omit it for the last three; or, if the omission belongs to paleographical error, such a multiple omission would be hard to justify. In light of this, Jan adds an extra ἡ in 9.5 and 9.6, but this is not a completely satsifactory solution; it toys with the manuscript tradition. On account of the difficulties involved here, especially on account of the disparity between the different parallels, it is probably wisest to leave the passage as the manuscripts (except Z) preserve it and to favor the manuscript tradition here in preference to parallels found elsewhere in the treatise.

διάστημα (from διαστῆναι) is a fundamental musicological term. It can be found as early as Archytas (2), but not earlier. It has technical meanings in other disciplines as well, especially in geometry where διάστημα means "radius" (Euc. 1.1), and in Hellenistic philosophy where it referred to "dimension."

9.4 Homer used μέγεθος to describe a person's "stature," and other authors use the word to mean physical "size"; but mathematicians adopted it as a technical term signifying "magnitude." Ptolemy uses the word to describe the "magnitude" of stars in his Almagest, and so it is not surprising to find the word in musicology as well. It is probably the mathematical use that first influenced musicologists since it is the arithmetical difference between intervals which Cleonides terms as μέγεθος. μέγεθος can also be found very frequently in Aristoxenus, Aristides, Bryennius, Nicomachus #2, Bacchius #73, Gaudentius

#9, [Ptolemy] #15, and see also Arist. Metaph. $1052^{b}30$.

9.6 ἡ: sc. διαφορά

The difference between intervals which Cleonides discusses first is size. Actually, the other differences between intervals all revert to this difference; that is, intervals differing in consonance and dissonance, rationality and irrationality, also differ in their size. If these intervals differing in consonance or rationality were the same size, there would be no other difference possible; it is the particular size which makes an interval consonant or dissonant and rational or irrational. Nonetheless, Cleonides treats all five types of intervallic differences with equal importance.

9.8-9 Some of the manuscripts here add τριημιτόνιον (M^{1}(U)) after τόνος and δίεσις after ἡμιτόνιον (9.9). τριημιτόνιον and δίεσις are certainly both intervals, and both help to illustrate the size of intervals; τριημιτόνιον is one halftone larger than τόνος and one halftone smaller than δίτονον. (These calculations are according to Aristoxenian method, not Pythagorean.) The δίεσις is smaller than the ἡμιτόνιον—the smallest interval discussed in detail by Cleonides. Moreover, Cleonides seems to be listing notes essential to tetrachordal construction, and both these intervals apply here.

The order of the first of these two insertions does not assist their prospects for validity; Cleonides, orderly as usual, seems to descend in order for those intervals smaller than the tetrachord length. τριημιτόνιον, however, is placed after τόνος, and yet it is a larger interval. (Meibom transferred it to in front of τόνος.) On the other hand, δίεσις is last in the progression, as it should be. Paleographi-

cally, it is much easier to explain conjectural additions by M^1 at 9.8, 9.10, and 9.18 than it is omissions by MCP at the same three places. Ultimately, the acceptance or rejection of these two intervals is not of great import; both intervals are, of course, intervals, and Cleonides is only purporting to give examples of intervals. For an example of a list in the treatise which may include an illogical, unorderly progression, see infra, 21.18.

9.11 Cleonides' first use of the adjective διατονικός instead of διάτονος; the two are apparently not interchangeable. For the difference, see infra, n. 11.10.

In this passage and elsewhere V and several other manuscripts write διατεσσάρων, διάπεντε, and διαπασῶν as one word; cf. Jan at 15.11.

9.12 The third difference between intervals is their consonance and dissonance. Some intervals were deemed consonant by the Greeks, and these were, generally speaking, the fourth (διὰ τεσσάρων), fifth (διὰ πέντε), octave (διὰ πασῶν), eleventh (διὰ πασῶν καὶ διὰ τεσσάρων), twelfth (διὰ πασῶν καὶ διὰ πέντε), and double octave (δὶς διὰ πασῶν). For the Pythagoreans the consonances were those intervals which could be expressed by simple integer ratios, i.e. 2:1 (διὰ πασῶν), 3:2 (διὰ πέντε), 4:3 (διὰ τεσσάρων), 3:1 (διὰ πασῶν καὶ διὰ πέντε), and 4:1 (δὶς διὰ πασῶν). They were reluctant to accept the eleventh since its integer ratio was not "simple, multiple, or superparticular, but 8:3. See Boethius 2.18-19.

Besides συμφωνία and διαφωνία, Greek musicologists also made mention of ἀντιφωνία and παραφωνία. The former referred to notes which stood an octave apart (Gaudentius #20), and it was therefore a sub-

species of συμφωνία. The latter term is problematic; see Bacchius #61, Gaudentius #8, [Longinus] 28.1, Theon 5, and see also the notes in D. A. Russel, ed., [Longinus] (Oxford 1964) ad loc.. For ὁμοφωνία, see Martianus Capella #947.

σύμφωνος and συμφωνία were recognized as technical musicological terms by the fourth century B.C. In the late fifth century the words referred generally to harmonious music, but not to specific intervals; cf. Ar. Av. 221 and S. Ich. 319. In the fourth century Plato (Rep. 531 A, C) used συμφωνία to refer to the musical concords of the dia tessaron, dia pente, and dia pason, as (seemingly) did [Aristotle] (Prob.921^{a}23: ἡ διὰ πασῶν συμφωνία). [Aristotle] (Prob. 918^{b}30) for certain differentiated σύμφωνος from ἀντίφωνος and ὁμόφωνος. From such usage Aristoxenus and all the later musicologists use the term to mean specifically the concords of the dia tessaron, dia pente, and so on. Metaphorically in the fourth and later centuries, philosophers use the term frequently to mean "harmonious," but they do not refer in this way to specific musical intervals.

διάφωνος and διαφωνία are not nearly so common outside of musicology, nor did they take on their technical meanings until after Plato and Aristotle. Aristoxenus uses the word often; perhaps he developed its technical usage.

Parallels for σύμφωνος and διάφωνος can be found at Ptolemy 1.7, Porphyry (citing Aelian Platonicus) 96, Gaudentius #8, Nicomachus 262, Aristides 9.26-10.6, [Arist.] 19.38, Polybius (ap. Ath. 14.615 D), Bacchius #59, Sectio Canonis 17, and Theon 5.

9.15 καὶ τὰ ὅμοια: These include the διὰ πασῶν καὶ διὰ τεσσάρων, διὰ πασῶν καὶ διὰ πέντε, δὶς διὰ πασῶν, and still two others--the δὶς

διὰ πασῶν καὶ διὰ τεσσάρων, δὶς διὰ πασῶν καὶ διὰ πέντε. See infra, 16.20-17.2, and Porphyry 96.

δίεσις (from διίημι) originally means "a sending through." Musicologically it technically signifies the quartertone, but Cleonides will slightly alter this in discussing shades. Cf. Theon 12, though Aristotle (APo. $84^{b}39$) and Dionysius of Halicarnassus (Comp. Verb. 11) refer to it simply as the smallest note in the scale. In Problems $917^{b}36$ and Philolaus 6 δίεσις refers to a halftone in the diatonic scale. Exactly how these meanings derive from "a sending through" is not at all certain. See also, W. Burkert, Lore and Science in Ancient Pythagoreanism (E. Minar, trans.) (Cambridge 1972) 390, n. 19.

9.18 Several manuscripts ($M^{1}U$) add τριημιτόνιον after τόνος. Jan omitted the word from his edition as I do mine. The problem is very similar to that at 9.8-9.9, q.v. The problem involves the possible insertion or omission of one word in a scientific list, a word which actually (that is, scientifically and musicologically) belongs there. To print τριημιτόνιον after τόνος would be only to do justice to the treatise, if not to Cleonides; but the twentieth-century editor is not allowed such liberty if the manuscripts are not overly convincing. Again as in 9.8-9.9, ultimately it does not matter.

Cleonides mentions the tritone, tetratone, and pentatone, intervals which do not appear in musicological theory very often. This scarcity is due to the fact that these intervals lie outside of the tetrachordal structures and are not significant within the perfect systems; at least the Greek musicologists do not discuss them in that context. They can be found in the following passages: tritone--Bryennius 100.24,

104.8, 162.6, 25; Cleonides 11.6, 15.11; Bacchius #47; tetratone--Bryennius 100.24, 162.2, 7, 19, 24, 31; Bacchius #47; and pentatone--Bryennius 100.24, 162.2f.; Bacchius #47. (Bryennius 100.24 repeats Cleonides' sentence; 162.2f. is from Bacchius.)

9.19 και τα ὅμοια: These would include all the other notes in existence larger than the dia tessaron other than the other consonances; these would be the heptatone, octatone, and so on. Cleonides does not allow for the other dissonances which are smaller than the dia tessaron, e.g. the intervals he will mention later in discussing the χρόαι (12.6-15.2) such as the three-quarter tone, one-third tone, eleven-sixths tone, etc.

9.20 δυοῖν is the more common accompaniment for duals in the genitive and dative, but δύο is acceptable. δυοῖν is rarely used with plural nouns; ὀξυτέρου and βαρυτέρου are to be labeled distributive singulars, and δυοῖν in Q is not then essential.

Q also contains a version of 9.20, 10.1f., apparently borrowed from Porphyry (35.26-28; 89.16-24) and reused in Bryennius (11.14-21).

10.1 Jan represents διαφωνία--ἁμιξία in small print (Menge in angle brackets), for he did not know whence it came: Meib. ex Pena puto editione. S (with Vat. Reg. 169--the manuscript Pena used) contains this sentence. The manuscripts are clearly wrong here, for except for the version preserved in S they describe consonance as if it were dissonance. Other than Q, which recognized the problem and omitted the entire passage, all the manuscripts include some reference or des-

scription of διαφωνία, for they all have some variant of ὥστε μὴ κραθῆναι, ἀλλα τραχυνθῆναι την ἀκοην. Nonetheless, none of these diaphonic passages makes sense except the version of S which clearly divides consonance and dissonance. It seems that the scribe of S made an excellent conjecture to restore part of the text which has been (partially) lost in the rest of the tradition; for this reason I print the sentence as found in S. Since all the other manuscripts are in the wrong here, it is highly doubtful that their ὥστε μὴ κραθῆναι is any more reliable. Therefore μὴ οἷων τε κραθῆναι (S) should be preserved. There is a great doubt in attributing S's version to Cleonides, however, for ἁμιξία is a hapax in the Greek musicologists and no where else does Cleonides use the aorist passive; he uses the idiom οἷός τε plus infinitive only at 11.4-5.

On the other hand, κραθῆναι (from κεράννυμι) picks up the idea implied in κρᾶσις(9.20). The idea of "mixing" is used in describing music as early as Plato (Leg. 835 B: ἁρμονίας ῥυθμοῖς κραθείσας). Only S reads κραθῆναι; MCP have καθαρθῆναι (from καθαίρω), and the concept of "cleansing" never found its way into the technical vocabulary of musicology. καθαίρω is used technically and semi-technically by physicians (e.g. Hp. Mul. 1.64) but not by musicologists. κράσις is an established term in musicology, particularly in discussions of consonance. Cf. [Arist.] 19.38, Aristides 127.5, 84.9, Bryennius 100.18.

τραχυνθῆναι (P's τραχῦναι is unattested in LSJ; the scribe omitted -θην) meant "made rough or harsh" (LSJ I.1). The word is found as early as Aristophanes, but it had no connection with sound at the time. Plutarch (TG 2) uses it in the passive with τῇ φωνῇ, and

Dionysius of Halicarnassus (Comp. Verb. 22) uses it with τας ἀκοας to mean "to grate roughly on the ears." Cleonides uses this exact same idiomatic expression--τραχυνθῆναι την ἀκοήν. As with μουσική, the musicologists were not too interested in "hearing" as a science; the science of harmonics had more importance for them, and so ἀκοή cannot really be designated as a technical term. The verb τραχύνω is found in [Arist.] Prob. 11.22. Aristides 79.10, 81.9, and Bryennius 146.1.

10.3 Cleonides now discusses the fourth difference between intervals--whether they are composite or non-composite (10.3-11.2). Composite (σύνθετα) intervals are those intervals which are composed of two or more smaller intervals; a non-composite (ἀσύνθετα) interval is not composed of smaller intervals but is instead one single, indivisible interval. For examples we might look at all three genera. In the diatonic tetrachord there is one halftone and two tones. The halftone is the smallest interval to be found in the diatonic genus, and so it must be non-composite; it is constructed of just one halftone. Similarly, the two whole tones are each non-composite. In the chromatic genus the tetrachord consists of two halftones and one trihemitone. Each halftone is non-composite and so is the trihemitone. If one takes the two halftones together, however, he now has a composite whole tone; it is composed of two halftones. Similarly, the halftone and first whole tone in the diatonic genus are by themselves each non-composite, but added together to make one and one-half tones they now form a composite trihemitone. Similarly, the two tones in the diatonic genus are each non-composite tones, but added together they form a composite ditone, i.e. composed of two whole tones. In the enharmonic

genus, however, there is a non-composite ditone. Lastly, the two quartertone dieses in the enharmonic genus are each non-composite, but added together they form a composite halftone.

Cleonides organizes this section by first defining non-composite intervals and giving two examples, then by defining composite intervals and giving three examples, and then by explaining how certain intervals can be both composite and non-composite in the different genera--a phenomenon which has just been explained here. Cleonides' examples include the halftone, whole tone, trihemitone, and ditone in the three genera. Lastly, he announces that intervals smaller than the halftone are all non-composite; those larger than the ditone are all composite. These two facts are necessary because of the emphasis on tetrachordal construction.

Parallel passages examining composite and non-composite intervals can be found at Martianus Capella #948-49, Aristides 10.19-23, Bacchius #64, Aristoxenus 75.11-76.9, and Bryennius 102.1-13.

σύνθετος and ἄσυνθετος are technical terms for Cleonides as well as Aristoxenus, Aristides, Gaudentius, Maritanus Capella, Bryennius, and Ptolemy (57.10). Like μέγεθος, κίνησις, and συνεχής, these terms were used with technical meanings in many other philosophical and scientific disciplines. "Synthesis," of course, was essential to the vocabularies of Aristotle (Metaph. $1092^{a}26$) and Plato (Sph. 263 D) when discussing grammar, or Isocrates (10.11) in discussing rhetorical composition, of Archimedes (Sph. Cul. 2.7) and Euclid (5 Def. 14) in mathematics, and again of Aristotle (SE $177^{a}33$) when discussing logic or (PA $646^{a}12$) physics. The word also had its uses in metrics; Plato speaks (Rep. 400 B) of σύνθετος ῥυθμός ("a compound foot"), and from

here the word seems to have been extended to musicology and applied to intervals "composed of" more than one interval. Once this happened, ἐσύνθετος was made into a technical term as its antonym; before this ἀσύνθετος was not widely used except by grammarians (LSJ I).

10.6 It is curious that Cleonides refers to the notes without tetrachordal qualification, i.e. ὑπάτη instead of ὑπάτη ὑπάτων or ὑπάτη μέσων. It does not matter, of course, which specific notes Cleonides means in the case of composite intervals, for παραμέσης καὶ ὑπάτης (10.9-10) can stand at three and one-half tones apart (παραμέση to ὑπάτη μέσων) or an ocatve (six tones) apart (παραμέση to ὑπάτη ὑπάτων) and still be composite. But for non-composite intervals, ὑπάτης και παρυπάτης can qualify as a non-composite interval only if the two notes are in the same tetrachord, e.g. ὑπάτη ὑπάτων and παρυπάτη ὑπάτων, or ὑπάτη μέσων and παρυπάτη μέσων. Part of the difficulty results from the rather unrelated character of this whole passage; it makes little difference to a musicologist studying genera and their various notes whether notes are composite or non-composite except within the individual genus' tetrachord, and Cleonides has already discussed these intervals. Also, Cleonides confuses the reader by saving for last his dictum τὰ μείζω τοῦ διτόνου πάντα διαστήματα σύνθετα. This principle necessitates the inclusion of ὑπάτη and παρυπάτη (10.6) in the same tetrachord, though the reader cannot know this until later.

10.7 τῶν λοιπῶν διαστημάτων must refer to all the possible non-composite intervals in the greater perfect system, e.g. from trite to paranete, paranete to nete, proslambanomenos to hypate, etc. It

would also include intervals smaller than or equal to the ditone; this would no doubt involve the irregular intervals in the "shades" of the genera; see infra, 12.6.

10.9 The intervals mentioned--μέσης καὶ παρυπάτης, μέσης καὶ νήτης, παραμέσης καὶ ὑπάτης--are of the following size in the three genera; (the chart is on p. 248).

Notice here that Cleonides can refer to an interval as either ascending (μέσης καὶ νήτης), or descending (μέσης καὶ παρυπάτης). The direction has no affect on the magnitude. The difference between μέση and νήτη συνημμένων is of xourse equal to the size of a tetrachord; the difference between μέση and νήτη διεζευγμένων is a dia pente, and μέση to νήτη ὑπερβολαίων is a dia pason. The same is true for παραμέση to ὑπάτη μέσων and παραμέση to ὑπάτη ὑπάτων. All intervals greater than the ditone are, by definition, composite. Conveniently, Cleonides has picked two of his three examples so that there will be no confusion between genera, for nete, mese, paramese, and hypate do not vary with tetrachord arrangement in each genus; they are all fixed notes.

10.11-12 Cleonides now turns to the exceptions, those intervals which can be both composite and non-composite. These are all the intervals involved in the tetrachordal variations between genera, i.e. from the halftone to the ditone. The quartertone diesis is not affected since it can appear in only the enharmonic genus. For further exegesis, see supra, n. 10.3.

The μὲν in Z would make matters clearer, and it has parallels in the ensuing three sentences. In each of these three sentences the first genus mentioned is accompanied by μὲν (after ἐν), the second (and

		διάτονος	χρωματική	ἐναρμόνιος
1	μέση—παρυπάτη (μέσων)	composite ditone (1 + 1)	composite ditone ($\frac{1}{2}$ + 1$\frac{1}{2}$)	composite 2$\frac{1}{4}$ tones ($\frac{1}{4}$ + 2)
2	μέση—παρυπάτη (ὑπάτων)	composite 4$\frac{1}{2}$ tones (1 + 1 $\frac{1}{2}$ + 1 + 1)	composite 4$\frac{1}{2}$ tones ($\frac{1}{2}$ + 1$\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$+ 1$\frac{1}{2}$)	composite $4\frac{3}{4}$ tones ($\frac{1}{4}$ + 2 + $\frac{1}{4}$ + $\frac{1}{4}$+ 2)
3	μέση—νήτη (συνημ.)	composite 2$\frac{1}{2}$ tones (διὰ τεσσάρων) ($\frac{1}{2}$ + 1 + 1)	composite 2$\frac{1}{2}$ tones (διὰ τεσσάρων) ($\frac{1}{2}$ + $\frac{1}{2}$ + 1$\frac{1}{2}$)	composite 2$\frac{1}{2}$ tones (διὰ τεσσάρων) ($\frac{1}{4}$ + $\frac{1}{4}$ + 2)
4	μέση—νήτη (διεζ.)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) (1 + $\frac{1}{2}$ + 1 + 1)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) (1 + $\frac{1}{2}$ + $\frac{1}{2}$ + 1$\frac{1}{2}$)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) (1 + $\frac{1}{4}$ + $\frac{1}{4}$ + 2)
5	μέση—νήτη (ὑπερβ.)	composite 6 tones (διὰ πασῶν) (1 + $\frac{1}{2}$ + 1 + 1 + $\frac{1}{2}$ + 1 + 1)	composite 6 tones (διὰ πασῶν) (1 + $\frac{1}{2}$ + $\frac{1}{2}$ + 1$\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$ + $\frac{1}{2}$+ 1$\frac{1}{2}$)	composite 6 tones (διὰ πασῶν) (1 + $\frac{1}{4}$ + $\frac{1}{4}$ + 2 + $\frac{1}{4}$ + $\frac{1}{4}$ + 2)
6	παραμέση—ὑπάτη (μέσων)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) ($\frac{1}{2}$ + 1 + 1 + 1)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) ($\frac{1}{2}$ + $\frac{1}{2}$ + 1$\frac{1}{2}$ + 1)	composite 3$\frac{1}{2}$ tones (διὰ πέντε) ($\frac{1}{4}$ + $\frac{1}{4}$ + 2 + 1)
7	παραμέση—ὑπάτη (ὑπάτων)	composite 6 tones (διὰ πασῶν) ($\frac{1}{2}$+1+1+$\frac{1}{2}$+1+1+1)	composite 6 tones (διὰ πασῶν) ($\frac{1}{2}$+$\frac{1}{2}$+1$\frac{1}{2}$+$\frac{1}{2}$+$\frac{1}{2}$+1$\frac{1}{2}$+1)	composite 6 tones (διὰ πασῶν) ($\frac{1}{4}$+$\frac{1}{4}$+2+$\frac{1}{4}$+$\frac{1}{4}$+2+1)

third) by δὲ (also after ἐν). Because of the lack of quality and unreliability in Z throughout the treatise, μὲν should not be read here; but its insertion reflects a quality in Z far superior to most of its other conjectures.

10.16-17

All three genera contain ditones, but only in the enharmonic is it non-composite, an uninterrupted jump from lichanos hypaton or lichanos meson (or parhypate) to hypate meson or mese, respectively (or nete), f to a. The diatonic ditone is composed of two whole tones, f to g and g to a, and the chromatic ditone is composed of a halftone plus trihemitone, f to f# and f# to a.

The confused reading of M is wrong; the interval is clearly named τὸ δίτονον; cf. Aristides 11.2, Aristoxenus 63.2, and Bryennius 98.24. Scribes frequently had difficulty throughout the treatise in distinguishing δίτονον, διάτονον, and διτόνιον, only the first two of which are verified Greek words. The first is an interval, the second a genus, the third a scribal blunder. In this one passage alone, scribal difficulty and confusion can be found at διατόνῳ (10.13, 10.14, and 10.17), δίτονον (10.16) and διτόνου (10.11 and 11.2).

10.17 Cleonides adds, although belatedly, two useful axioms: 1) intervals smaller than the halftone are always non-composite. Such intervals would include the diesis and third-tone; see <u>infra</u>, 12.14. Others might be found in the second book of Ptolemy's <u>Harmonics</u>, and 2) intervals larger than the ditone are always composite. Such intervals

would include the tritone (1 + 1 + 1), tetratone (1 + 1 + 1 + 1), and double octave (twelve tones: $2\frac{1}{2} + 3\frac{1}{2} + 2\frac{1}{2} + 3\frac{1}{2} = 1 + \frac{1}{2} + 1 + 1 + \frac{1}{2} + 1 + 1 + 1 + \frac{1}{2} + 1 + 1 + \frac{1}{2} + 1 + 1$), and so on.

πάντα (11.1) is a superfluous word in the first axiom, for only two itervals, the quartertone diesis and the third-tone diesis (δίεσις τριτημόριον) are smaller than the halftone; this is even true of the other fractional χρόαι (see 12.6f.) which are composed of διέσεις and of no smaller building block. πάντα may have been written by Cleonides in the hope of balancing the πάντα in the parallel phrase ὁμοίως δὲ καὶ τὰ μείζω τοῦ διτόνου πάντα σύνθετα, but it is in any case unnecessary and rather misleading in connection with intervals smaller than the halftone. On the other hand, it is not impossible that Cleonides could be referring to the multitudinous ratios promulgated by Pythagorean musicologists. By principle Aristoxenians did not accept those intervals or even recognize their existence, but Cleonides seems to recognize them in the next passage or irrational (ἄλογα) intervals.

11.2 Cleonides has reached the fifth and final difference between intervals, the difference between rational (ῥητά) and irrational (ἄλογα) intervals. The Aristoxenians had little use for the irrational intervals except when discussing the shades (χρόαι) of the genera. Examples of rational intervals Cleonides gives are the whole tone, halftone, ditone, and tritone. The whole tone can be arithmetically phrased as either a relationship of integers (9:8) or as a decimal number (1.125); the halftone (according to Aristoxenians) as 9:8÷2 or .5625; the ditone as 9:8 x 2 or 2.25; the tritone as 9:8 x 3 or 3.375. Other rational intervals would include all multiples of the whole tone, e.g. the tetra-

tone (9:8 x 4 or 4.49), the pentatone (9:8 x 5 or 5.625), the octave (9:8 x 6 or 6.75) and the double octave (9:8 x 12 or 13.5). The trihemitone (9:8 x 3:2 or 1.6875) is rational as well, as are the quartertone diesis (9:8÷÷ 4 or .28125), dia tessaron (9:8 x 5:2 or 2.8125), dia pente (9:8 x 7:2 or 3.9375), and third-tone diesis (9:8 ÷ 1:3 or .375). An example of irrational intervals found in this treatise would be 1/3 + 1/3 + 11/6, that is, the intervals in the "soft" chromatic shade (12.12f.) which is composed of two third-tones (1/3 + 1/3) and a remaining interval equivalent to a whole tone plus halftone plus third-tone (1 + ½ + 1/3 = 11/6). The other intervals in the six shades are rational:

enharmonic: ¼ + ¼ + 2 (.28125 + .28125 + 2.25)

soft chromatic: 1/3 + 1/3 + 11/6 (.$\overline{33}$ + .$\overline{33}$ + 1.8$\overline{33}$)

hemiolic chromatic: 3/8 + 3/8 + 7/4 (.375 + .375 + 1.75)

tonic chromatic: ½ + ½ + 1½ (.5625 + .5625 + 1.6875)

soft diatonic: ½ + 3/4 + 5/4 (.5625 + .84375 + 1.40625)

syntonic diatonic: ½ + 1 + 1 (.5625 + 1.125 + 1.125

Cleonides does not waste much effort on this passage. He merely establishes the terms ῥητός and ἄλογος, defines ῥητός and gives four examples and then defines ἄλογος. The passage is quite brief and not overly informative. For parallel passages, see the following: Michaelides ("rheton-alogon" 290) claims that Aristoxenus opposes the Pythagorean mathematics which are inherent in distinguishing rational from irrational intervals. He says, "According to Aristoxenus an interval is rational...which can be evaluated by the ear (γνώριμον κατὰ μέγεθος, ἤτοι ὡς τά τε σύμφωνα καὶ ὁ τόνος ἢ ὡς τὰ τούτοις συμμετρ') "that [interval] the size of which is known (recognizable), as the

concords and the tone, or as the intervals commensurate with these." Aristoxenus says nothing about recognizing rationality with the naked ear, nor do the other Aristoxenians. Aristides (11.5) says, ῥητὰ μὲν οὖν καὶ ἔστιν εἰπεῖν ποιόν (λόγον δέ φημι τὴν πρὸς ἄλληλα κατ' ἀριθμὸν σχέσιν, clearly a mathematical, not aural interpretation of rationality. Bryennius (102.16-22) repeats the words of Cleonides.

ῥητός (from ἐρῶ) entered the musicological vocabulary via the mathematical. Plato (Rep. 546 C) uses ῥητός to describe a "rational" magnitude in a mathematical discussion, and he is followed in this technical usage of the word by Euclid (10 Def. 3, 4). Aristides (33.20) uses ῥητός to describe a "rational" metrical foot (ῥητος ποῦς), but he also uses (11.4) the word to describe an interval. ῥητός as a mathematical term is also used by Gaudentius 328.17 and Martianus Capella #949: logica and rationabilia.

11.9-15.2 Cleonides here begins the third major subject for discussion, genus. He follows or parallels most other Aristoxenians in discussing genus after notes and intervals, yet he has already found it necessary to introduce the reader to the three genera during the φθόγγος discussion (3.12-4.3). There, Cleonides was about to list the eighteen notes in each of the three genera; he preceded the note-lists with a description of the formulation of each genus. The present discussion on genus does not repeat what has already been given. Cleonides divides this passage into three sub-divisions: 1) a description, or rather a listing of five types of melody--diatonic, chromatic, enharmonic, common (κοινόν), and mixed (μικτόν) (11.9-18); 2) a description of the locus of the movable notes (lichanos and parhypate) through the three genera (11.18-12.5); and 3) a lengthy discussion of the six shades

(χρόαι) of the genera. This last subdivision is itself divided into several parts, for which see infra, n. 12.6. For parallel discussions of genus, see Aristoxenus 57.13-65.20; Nicomachus #12; Ptolemy 1.12-15; [Plut.] 1137 E-1134 F; Bacchius #21-25; Theon 10-11; Anonymous Bellermann #52; Aristides 15.21-19.10; Bryennius 12.12-16.7; Psellus 27; Gevaert, Histoire et théorie de la musique de l'antiquite (Gand 1895) I, ch. 4; Jan Erklärung zu Bacchius (Strasbourg 1891) 3; and Michaelides "genus" 121-22.

Just as the sub-title Περὶ φθόγγων had been added at 1.9 (NQ), so here Z supplies the sub-title Περὶ μέλους. Cleonides is not about to discuss "music" as this title would lead one to believe, though he does use the word μέλος once (11.10). Cleonides will only discuss the three genera, their shades, and then the systems and tones. This type of material still falls under the category of musicological groundwork; without it music is unorganized and cacophonous, but with all this material there is still no μέλος in the strictest sense of the word. Nonetheless, the Περὶ φθόγγων section of the treatise has come to its conclusion; all the notes have been named, categorized, located, and differentiated by interval. Those studies are now about to expand into a broader compass.

τὰ προειρημένα: first at 3.12 and then elsewhere. It would not have been laborious for Cleonides to write here Γένη δέ ἐστι τρία· διάτονον, χρῶμα, ἁρμονία.

11.10 διατονικόν differs from διάτονον in that διάτονον is an adjective used (as a noun) to name the genus itself or to name one of the movable notes found in the genus, e.g. λιχανὸς μέσων διάτονος. διατονικόν is also an adjective, but it is the non-technical adjective

which describes something used in a diatonic way. Cleonides uses διατονικός with μέλος (11.10), with διαίρεσις (11.12), with σύστημα (15.7). διάτονον is used 1) as the name of the genus at 3.12, 11.16-17, and 14.7; and 2) as part of the name of a note at 4.8, 11, 14, 18, 21, 8.22-9.2, and elsewhere. χρῶμα and χρωματικός are distinguished similarly (cf. 11.10 and 11.16), but χρῶμα is, of course, a noun and is therefore not used as part of a name for a movable note (5.5, 8, 11, 15, 18). The same distinction is used for ἁρμονία and ἐναρμόνιος, though again ἁρμονία is a noun and is restricted to naming only the genus (11.17), not its notes (5.24, 27; 6.1, 2, 5, 6, 8, 9).

11.14 A common melody (κοινον μέλος)is that which avoids the movable notes. Since the pitches of movable notes determine the genus of the music, a melody which is played only on fixed notes will not belong to any specific genus but rather to all three in common.

ἑστώτων here is the technical term, referring specifically to the eight fixed notes. P's φθόγγων after ἑστώτων is not necessary if one is to judge by Cleonides' diction elsewhere in the treatise; cf. 7.16f.

κοινός, besides its many uses in the world of government and personal or social relations, had several technical uses in antiquity among logicians, mathematicians, and grammarians; the latter described a syllable which could be long or short, a stanza of various types of cola, a poem of ambiguous metrical form, and so. As a musical term it is used by Cleonides to describe common notes (21.15), common tetrachords (23.10), and common intervals (10.10). See also Bacchius #81, Gaudentius 33.1, [Arist.] 19.42, Aristides 13.12, 13 and 14.2, Aristoxenus 34.14, et al, and Bryennius passim; cf. also 27.17.

11.15 The fifth and last melodic possibility is that of mixed genera. Cleonides already listed the notes in a mixture of genera (μίξιν τῶν γενῶν) at 6.11f. This particular μικτὸν μέλος differs slightly from that in that various combinations of two genera are allowed as well as the single combination of all three genera together. Cleonides mentions all the possibilities of music composed of mixed genera: diatonic with chromatic, diatonic with enharmonic, chromatic with enharmonic, and diatonic with chromatic and enharmonic

χαρακτήρ was a word widely used in antiquity. Originally meaning "engraver," it eventually developed into a word referring to anything "stamped" or possessing a "distinctive" mark. Not to be found frequently in our extant musicological treatises, Cleonides uses it only here and at 28.10, and the only other authors to use it are [Arist.] 19.59, Bryennius 122.6 (=Cleonides 28.10), 116.5 (=Cleonides 11.15), 120.6, Aristides 22.12, 72.19, 76.20, 85.17, and Ptolemy 94.15.

11.16 In omitting ἢ διατόνου--χρώματος (11.18), the scribe of C skipped from χρώματος (11.16) to χρώματος (11.18); the same type of error was committed by the scribe of U who skipped from one ἁρμονίας to another in 11.17.

11.18 Cleonides begins now the second (of three) sections in his γένος discussion (11.18-12.5). He delineates the locus of the movable notes in the three genera. In doing so he uses only the movable notes lichanos and parhypate (of the hypaton and meson tetrachords); he ignores trite and paranete (of the synemmenon, diezeugmenon, and hyperbolaion tetrachords). The locus (τόπος) of the lichanos is one whole tone, that of the parhypate a quartertone (δίεσις). For the specifics,

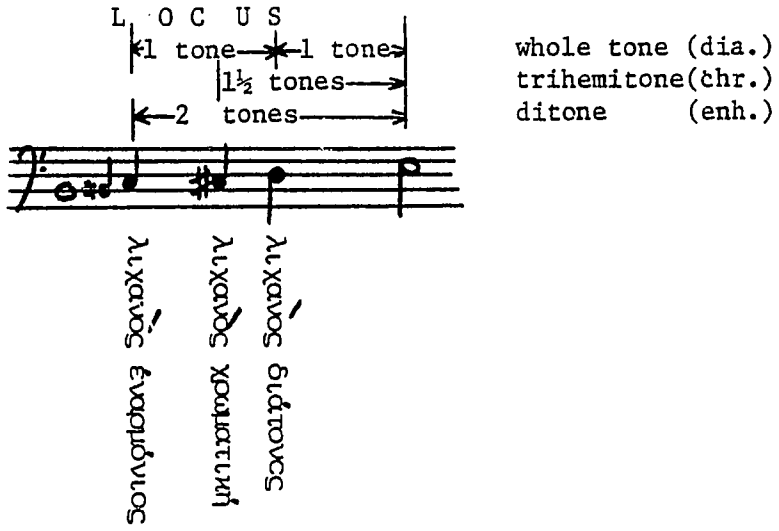
see infra, 11.20 and 12.2; the locus of the trite and paranete would be the same as that of the parhypate and lichanos, respectively.

11.19 Cleonides never expected to be a great writer, if one judges by his simplistic style and lack of detail or intellectual curiosity, but he did expect to be clear and consist ent. One must then wonder what the author had in mind when (and if) he wrote παρὰ τοὺς κινούμενος τῶν φθόγγων here. To have been more consistent, Cleonides should have written τοὺς κινούμένους φθόγγους or τοὺς κινουμένους τοὺς φθόγγους or more preferably just simply τοὺς κινουμένους; cf. 11.14. U tried to correct the stylistic difficulty by adding τόπους after φθόγγων, "the movable places of notes"; but it is not really the τόποι of the notes that are movable, it is within the τόποι that the notes themselves are movable. This is certainly what Cleonides has made clear in 8.8-8.21, and he will imply if further throughout the passage presently being discussed. He says κινεῖται δὲ ἡ μὲν λιχανὸς, (11.20) not κινεῖται δὲ ὁ μὲν λιχανοῦ τόπος. The lack of any manuscript support forbids a conservative modern editor from deleting τῶν φθόγγων, but this editor at least registers a complaint as to its unfortunate and curious presence (in γ). Perhaps Cleonides once again is giving us detail for clarity's sake, but which only confuses the reader.

11.20 Cleonides uses the word τονιαῖος again at 27.14; at 13.3, 7, and 14.23 it describes a "shade" of genus. It can be found in [Arist.] 19.47 and in Aristoxenus POxy. 667.20.

διεσιαῖος is found only at Nicomachus 279.16, Aristides 111.20, and Theon 91.

11.21 The locus which the lichanos, a movable note, traverses in moving from genus to genus equals one whole tone. In the diatonic genus the lichanos will be located one whole tone beneath the uppermost (highest) boundary of its tetrachord; in the chromatic genus it will be located one and one-half tones (trihemitone) beneath the uppermost boundary of its tetrachord; and in the enharmonic genus it will be located two tones (ditone) beneath the uppermost boundary of its tetrachord. The locus of the lichanos in all its possible locations is therefore one whole tone. (This is true in both lower tetrachords, and the same holds, of course, for paranete in the upper three tetra chords:



A similar diagram could be drawn for the meson tetrachord.

The article τῷ proposed by C should not be admitted into the text. It is not "the" specific location of the tone; no such location exists. Rather, the lichanos moves about within the locus of a tone, or, to paraphrase the Greek, "in a tonal locus."

Although the manuscript tradition left us with almost as many readings as there are manuscript groups, the appropriate Greek ad-

jective formed from δίεσις cannot possibly be so hard to find. Jan's reading of διεσίω in L was incorrect, and so διεσιαίω (PM^1) must be correct; one need merely consult Aristides 111.20 to find διεσιαῖος. This form is also found in Theon 91 and Nicomachus 279.16.

12.1 V and Jan write ἐτέρου for ὀξυτέρου, and it is very difficult to understand their reasoning. There is nothing, no "other" to which ἐτέρου might refer. One might argue that after ἐτέρου could be supplied a τόνου and that this phrase would then make it clear that τόνος was the "other" to which ἐτέρου referred. In fact, Z and U^1 supply this phantom τόνου. But "the highest lichanos" is not "that lichanos which is located a tone away from the other tone of those limiting the tetrachord." This version of the text does not provide the full specifications for the highest lichanos. The reading of ὀξυτέρου in M, however, makes the location of the highest lichanos perfectly clear: "That lichanos which is located a tone away from the highest [note (φθόγγου)] of those limiting the tetrachord." Moreover, the parallel sentence below--such parallels are so often of great assistance in Cleonides' treatise--reads ἀπὸ τοῦ βαρυτέρου, and this wording also suggests that ὀξυτέρου is correct.

12.2 The locus which the parhypate (hypaton and meson) traverses in helping to form the three genera equals the quartertone diesis. In the diatonic genus the parhypate is located two whole tones (ditone) beneath the highest note in the tetrachord; in the chromatic genus it is located again at tha same spot one ditone beneath the highest note in the tetrachord; in the enharmonic genus it is located two whole tones plus one quartertone diesis beneath the highest note in the tetrachord.

Cleonides locates these notes in relation to the bottom notes of the tetrachord--one halftone above it in the diatonic and chromatic genera, and one quartertone above it in the enharmonic.

12.3 The substitution of μέση for μὲν (U) is impossible. What is interesting here, however, is the omission of an exceedingly common word, μέν, in favor of a relatively obscure technical term, μέση. The scribe was thinking about musicology subconsciously and has given us a fine example of the facilor lectio as the correct reading.

12.6-15.2 Cleonides begins here the lengthy third sub-division of his genus discussion, the passage on the six shades (χρόαι) of the genera. Shades are variant tetrachordal divisions. These shades are discussed by both Aristoxenian and Pythagorean theorists, but their specific shades differed. The mathematics which lie behind Ptolemy's eight χρόαι (five diatonic, one enharmonic, two chromatic) are beyond the scope of this commentary on an Aristoxenian author; see Ptolemy 1.12-16 where he discusses the tetrachordal divisions promulgated by Aristoxenus and Archytas and then proposes his own. See also, C. André Barbera, "Arithmetic and Geometric Divisions of the Tetrachord," Journal of Music Theory 21 (1977) 294-323. Aristoxenus (62.14-65.20) proposes the same six as Cleonides, that is, one enharmonic, three chromatic (soft, hemiolic, and tonic), and two diatonic (soft and syntonic). Each shade will be discussed individually below. Other discussions of χρόαι besides those already cited can be found in Aristides 17.8-18.4, Martianus Capella #959, Bryennius 114.8-116.7, [Ptol.] #17, Gaudentius #5, [Plut.] 1143 E, Porphyry 157.21-29, and Pachymeres 422-23.

Cleonides divides this section into two parts, the first (12.6-14.4) beginning with a definition of χρόα (γένους εἰδικὴ διαίρεσις) and an announcement that there are six, and then a discussion of each of the six in detail beginning with the enharmonic and finishing with the diatonic. The second part (14.12-15.2) explains the arithmetical composition of each shade. Basically, each tetrachord is adsigned a numerical value of thirty, and then each shade is divided accordingly.

The manuscripts are very confused and confusing throughout this passage. Since Cleonides is one of the major sources for generic shades, no doubt countless Byzantine and Renaissance scholars and students paid special attention to this section of the treatise. Those same scholars and students not only studied this section, they also seem to have manipulated its form and content.

Not all the musicologists call these shades χρόαι. Aristides (17.10), for instance, refers to them as εἴδη. The word χρόα could also be used in connection with φθόγγοι, as in Gaudentius #2.

12.7 γνώριμοι, like εἰδικός (actually εἶδος) and διαίρεσις, is found in the Platonic corpus, but it is not a technical term. Here Cleonides uses the word as "well-known" (LSJ I.1). There were other χρόαι which he does not mention. See Ptolemy 1.12-16, and Aristides (185-86): γίνονται δὲ καὶ ἄλλαι τετραχορδικαὶ διαιρέσεις, αἷς καὶ οἱ πάνυ παλαιότατοι πρὸς τὰς ἁρμονίας κέχρηνται.

ῥηταί here does not have the technical meaning "rational," but merely the more common usage "spoken of."

12.9 The enharmonic "shade" actually has the exact same formation as the enharmonic genus, that is, ¼ + ¼ + 2.

Jan printed αὐτοῦ for αὐτῇ, claiming his reading was based on M^1. There is no αὐτοῦ in M, however, but in V (and PS, which Jan did not collate). M has αὐτῇ with its ending above the αὐτ-, and then this αὐτῇ was followed (correctly) by τοῦ γένους. Jan attributed the τοῦ, it seems, to αὐτ-. Strunk followed Jan's reading and translated the sentence, "The shade of the enharmonic uses the division of the genus itself"; this is perfectly good Greek and English syntax, but not perfectly clear musicology. It would be clearer to say, as do MC, "The shade of the enharmonic uses the same division as the genus," reading αὐτῇ. To state the sentence even more clearly, one would opt for both τῇ αὐτοῦ and τῇ αὐτῇ, and this we have in P: ἡ μὲν οὖν τῆς ἁρμονίας τῇ αὐτοῦ τοῦ γένους διαιρέσει τῇ αὐτῇ κέχρηται, "The shade of the enharmonic uses the same division as the genus itself." This may have been the original reading here, but the parallels in Cleonides suggest that the αὐτοῦ is unauthentic; at 13.3-4 Cleonides writes a statement parallel to this one in form and content: τὸ δὲ τονιαῖον, χρῶμα τῇ αὐτῇ τοῦ γένους χρόᾳ κέχρηται, and the same format is followed in 14.9-10. Observing the expected consistency of Cleonides' expression we should probably print τῇ αὐτῇ...διαιρέσει here. Lastly, Bryennius (114.10) seems to copy Cleonides, and he has ἡ μὲν τῆς ἁρμονίας χρόα τῇ αὐτῇ τοῦ γένους διαιρέσει καὶ αὐτη κέχρηται. In this case the second τῇ αὐτῇ added by our best manuscripts was probably found in a lost archetype and derived from a paleographical duplication.

12.10 Several manuscripts added τεταρτημόριον (P^1) or τὸ τεταρτημόριον τόνου (S) or τεταρτημόριον τόνου (Q) after δίεσιν. They did

this because it would soon become clear (or rather, it would soon become confusing) from the treatise that Greek musicologists recognized more than one diesis. Because they knew of the "normal" enharmonic quartertone diesis and the soft chromatic third-tone diesis (δίεσις τριτημόριος), the scribes took it upon themselves to clarify this sentence by specifying the "normal" quartertone diesis. One does this by modifying δίεσις with τεταρτημόριος(in the nominative case), and τεταρτημόριος can be made still clearer by qualifying it with an added τόνου. Cleonides has not yet announced the existence of the δίεσις τριτημόριος, however, and it is extremely doubtful that he would have bothered to qualify these dieses already. In addition, the very discussion at hand involved the enharmonic genus, and one could assume only that the dieses being discussed were enharmonic and thereby necessarily quartertones. Once again, however, the variants reveal how interested later readers were in understanding Cleonides' text as thoroughly as possible, and they also remind us that in a quondam texte vivant such as Cleonides' Εἰσαγωγὴ ἁρμονική paleographical science does not always render the text of an ancient technician as clear, precise, and informative as possible. The phrase δίεσιν τεταρτημόριον τόνου makes the note here described as specific as possible, while simple δίεσιν could puzzle a reader who already had read Aristoxenus and knew of the δίεσις τριτημόριος.

MC omit καὶ δίεσιν here which argues against any claims for the infallibility of these two twelfth-century manuscripts.

12.11 Q adds here another brief insert from Aristides (12.6-8), one of Aristides' descriptions of the diesis.

S (and Vat. Reg. 169, followed by Meibom) adds an unnecessary

12.12-15 Cleonides now begins to describe the three shades of the chromatic genus--μαλακὸν, ἡμιόλιον, τονιαῖον. The soft chromatic shade contains the third-tone diesis (δίεσις τριτημόριος τόνου), for which see supra, n. 12.10. The soft chromatic shade is composed as follows: One third-tone plus another third-tone plus the remaining difference from two and one-half tones, that is, four more thirds plus one halftone, or $4/3 + \frac{1}{2} = 11/6$. This last interval Cleonides describes as one tone plus one halftone plus one third-tone (τὸ ἴσον τόνῳ καὶ τῷ ἡμίσει καὶ τρίτῳ, that is, $1 + \frac{1}{2} + 1/3 = 11/6$. The soft shade is then formulated as follows: $1/3 + 1/3 + (1 + \frac{1}{2} + 1/3)$.

The variant in N and S is clearly a lemma from another author which has crept into the text here. The quotation is out of place here since Cleonides is discussing only the soft chromatic, not all three varieties of chromatic shades. The phrase which N and S add is not found in our extant Greek musicological treatises.

12.14 Greek musicology would not welcome the τὴν added by MCP. κατὰ δίεσιν is a common musicological expression, as are κατὰ τόνον, κατὰ ἡμιτόνιον, and the like; cf. 12.10, and especially 3.13-4.4 where Cleonides uses the expression to exhaustion. The article is not used in this idiom; MCP are found again to be incorrect.

C omits τόνου, an omission which one might suspect--except for the lack of broader manuscript support--may well date back to Cleonides. The word has the aura of a gloss about it.

12.15 Jan adds in his apparatus that, "5 sunt dieses sive 1¼ tonus in molli diatono," but the discussion of the soft diatonic shade is still paragraphs away, and he has not explained τὸ διὰ πέντε, nor is

there a trihemitone in the soft diatonic. It is found only in the tonic chromatic (½ + ½ + 1½). The variant in U^1Z should be ignored as nonsense.

The better manuscripts omit καὶ before τρίτῳ, but it should be considered original. There can be no such number as τῷ ἡμίσει τρίτῳ, especially in the soft chromatic shade. Jan should not have presented the καὶ in small print; Menge corrects this.

12.15-13.3 The second chromatic shade is the hemiolic (ἡμιόλιον). The hemiolic chromatic or "one (ὅλος) and one-half (ἡμι-)" chromatic is formed by adding the equivalent of one and one-half quartertone dieses twice (3/8 + 3/8) and then the difference of 20/8 - 6/8, which is 7/4. Seven-fourths of a tone is one whole tone plus three quartertone dieses (or plus one halftone plus one quartertone diesis), but Cleonides prefers to describe this quantity as ἑπτὰ τεταρτημορίων διέσεων ἀσύνθετον διάστημα, "a non-composite interval of seven dieses." One might reduce the whole formulation of the hemiolic chromatic to terms of dieses, that is 1½ dieses plus 1½ dieses plus 7 dieses; or describing 1½ dieses as 3/8, one could formulate as 3/8 + 3/8 + 14/8.

13.2 The reading in M^1U--ἑπτὰ διέσεων τετραμορίων--excels in clarity and grammatical construction. The inversion by P^1C confuses the meaning, and previously Cleonides has consistently put adjective or phrase which modifies δίεσις after the word δίεσις (δίεσιν τὴν ἴσην 12.11; δίεσιν τριτημόριον τόνου 12.14; δίεσιν τὴν ἴσην 12.14; δίεσιν ἡμιόλιον 13.1). τῆς ἐναρμονίου διέσεως (13.1) is the only exception, but this inversion results from the entire phrase's being part of the modifier for δίεσιν ἡμιόλιον; κατὰ δίεσιν ἡμιόλιον διέσεως

τῆς ἐναρμονίου is the less desirable alternative.

13.3 The variants in this line, like those in 12.15, are themselves varied in form and location. The reading in MP: ...ἀσύνθετον διάστημα ἑπτὰ διέσεων ὁ τρίτῳ ὁ τεταρτημορίῳ· τρὶς καὶ ἑπτὰ· εἴκοσι καὶ ἕν, explains the omission by M of τετραμορίων before ἀσύνθετον, but ἑπτα is read twice. ὁ τρίτῳ ὁ τεταρτημορίῳ is a crude way of saying that the seven quartertone dieses are the equivalent of four quartertones plus three quartertones. The interruption must have derived from a misplaced annotation. Similarly, τρὶς καὶ ἑπτὰ· εἴκοσι καὶ ἕν is a gloss (annotation) intrusion that refers to a numerical system for formulating the shades which Cleonides will not discuss until 14.12f. The This simple, arithmetical phrase, present in MCP(U) is 3 x 7 = 21.

13.3-5 Cleonides discusses the third chromatic shade; he formulates the tonic chromatic shade in the same way he formulated the enharmonic shade, that is, both shades are equivalent to the "normal" formulation of the genus' tetrachord. To form the tonic chromatic shade, Cleonides adds a halftone plus halftone plus trihemitone, or ½ + ½ + 3/2.

13.4 It is odd that none of the scribes of U omitted one of the two χρόᾳ. They all write χρόᾳ μέχρηται χρόᾳ.

13.5-7 Cleonides pauses for a moment to explain the terms μαλακόν, ἡμιόλιον, and τονιαῖον. It is not common for Cleonides to be so detailed as to explain why certain musical terms have their names. Aristides and [Plutarch] can do this because much of their work is historical in nature, and so they explain unessential--to the practical mus-

icologist (if there is such a person)--material. But Cleonides' work is an eisagoge, a simple introductory essay, and it is rare for him to explain the origin or terms. Nevertheless, we are grateful for this digression, even if Cleonides' explanations for the names τονιαῖον and μαλακον leave the reader quite unenlightened.

13.7f. sc. κέκληται.

The name τονιαῖον derives from the composite whole tone formed in the pyknon of the tonic chromatic shade, avers Cleonides. Two halftones do equal a composite (κατὰ σύνθεσιν) whole tone, and so the name τονιαῖον derives from the size of the pyknon--one whole tone from hypate to lichanos (nete or paramese to paranete). Yet the diatonic shades will not be named from the size of the (would-be) pyknon; the σύντονον probably refers to the two whole tones together, but certainly not in a pyknon. The single enharmonic shade was not named the ἡμιτόνιον χρῶμα in honor of its two dieses in the pyknon, and the μαλακόν shade does not describe a specific pyknon quantity at all. Actually, only the τονιαῖον χρῶμα and ἡμιόλιον χρῶμα derive their names from specific pyknon size.

13.8 Basing his reading on NB, Jan prints κατὰ σύνθεσιν (C^1), but the only reliable manuscript to have this phrase here reports the genitive κατὰ συνθέσεως (M^1); (the actual reading in M^1 is difficult to read, but U follows M^1 here). Either phrase is grammatically correct, for κατα with the genitive generally means "against," though "in" or "according to" can be understood, and the accusative more regularly means "in" or "according to"; M^1 should be followed here.

The phrase κατὰ συνθέσεως is conspicuous since it is Cleonides' first use of the noun form of σύνθετος. In his previous discussion (10.3-11.2) he used the adjectival form σύνθετος (or ἀσύνθετος) seventeen times, never the noun form. He also used the adjective form in a sentence parallel to the one in question here (14.6-9). Cleonides had to resort to the noun form here to preserve the semblance of fluidity in his style. Unlike authors who write in English, Greek authors frowned upon a succesion of varied, comma-divided, monotonous adjectives. They had at their disposal a more variable substitute--the prepositional phrase. Instead of writing ἀπὸ τοῦ ἐνυπάρχοντος αὐτῷ συνθέτου τόνου, Cleonides chose to write a more Hellenic ἀπὸ τοῦ ἐνυπάρχοντος κατὰ συνθέσεως τόνου.

Once again the editor of this treatise is faced with the problem: This phrase helps make the sentence clearer, yet its construction is relatively unique in the treatise, and the sentence could be understood without it. If Cleonides did not write it, he probably should have. And so, should it be included in the text?

Jan had the phrase surrounded by parentheses, but this was only, it seems, for the clarification of sense, not of Cleonides' original text. (Menge omitted the parentheses.) Since M^1 is the only reliable manuscript to preserve this passage here, its readings should be followed. Cleonides is quite specific about the details of hemiolic pykna (14.1-2), and so it is not too much to add the phrase κατὰ συνθέσεως here; cf. n. 16.16.

$MCPC^1P^1$ all make major omissions in the description of the hemiolic shade. The omissions vary, but none of them is satisfactory, for they all omit absolutely essential and irreplacable information,

as if either the hemiolic shade did not exist (M), or as if the hemiolic shade had the same construction as the soft shade (CP).

14.2 The word μαλακόν is not, like its predecessors τονιαῖον and ἡμιόλιον, an intervallic term. It describes a quality, and while quality may refer to size just as do τονιαῖον and ἡμιόλιον, it does not refer to a specific size. Moreover, the construction of the sentence describing the soft chromatic shade differs from the construction of the tonic and hemiolic senetences. No longer does the phrase τὸ...ἀπὸ ...ἐνυπάρχ. ἐν αὐτῷ κέκλησται appear. For this reason a colon instead of a comma should be placed before μαλακόν. Now only a simple ἐστι has to be supplied.

By ἐλαχίστου Cleonides refers to the interval formed by two of the διέσεις τριτημόριοι or third-tones. The size of the pyknon in the soft chromatic shade is two-thirds of a tone, a smaller size than the tonic (one whole tone) or the hemiolic (3/4 tone). By understanding this one can also probably understand why Cleonides (and Aristoxenus) call this shade μαλακόν instead of some numerically oriented word. Lastly, what would be the adjective in Greek for "two-thirds"? (The noun would be τὰ δύο μέρη.)

ἐκλύω is not really a technical term in any discipline other than medicine (Dsc. 4.169 "to relax" the bowels). It is a synonym for ἀνίημι (cf. ἄνεσις, n. 2.15). ἐκλύω can be found only at Aristides 83.32 (ἐκλελυμένος).

14.4 διατήκεται, "it is melted, softened," (Z) is obviously a gloss; ἐκκλύεται (C) results simply from doubling the kappa; the ἐκ (M) from omission; (and the κλύεται (Parisinus 2460[2]) from confusion

of the ligature for ἑπ, that is,).

14.5-11 Cleonides now discusses the shades of the diatonic genus. The diatonic genus contains two shades, the soft and syntonic. The soft diatonic (μαλακὸν διάτονον) varies slightly the "normal" (syntonic) diatonic configuration of halftone, whole tone, whole tone into halftone, non-composite interval of three dieses, non-composite interval of five dieses. One diesis has been removed from the lower whole tone of the syntonic diatonic, and it has been added to the higher whole tone. These dieses are, of course, the enharmonic quartertone variety, not the διέσεις τριτημόριοι of the soft chromatic shade. The intervals of three and five dieses must be non-composite since a tetrachord is by definition formed of four notes and three intervals, and a configuration such as ½ + (¼ + ¼ + ¼) + (¼ + ¼ + ¼ + ¼ + ¼) would be impossible. This soft shade of diatonic is instead formed by adding ½ + 3/4 + 5/4.

In both the soft diatonic and above (12.12) in the soft chromatic, the word μαλακόν seems to have referred to a very slight change in the genus formation. In the diatonic the lower whole tone was decreased (ἀνίεται καὶ ἐπιτείνεται) from four dieses to three, while in the chromatic the two halftones were decreased to two third-tones. This slight diminishing of pitch was apparently what made these shades in particular sound "soft."

14.8 The κατὰ supplied by U before πέντε is not desirable. Cleonides generally begins the formulation of a genus with κατά, but he does not repeat the preposition before the second and third elements; cf. 14.11, and especially 3.13-4.4.

14.9 The syntonic diatonic, as one might expect, is formulated ½ + 1 + 1. Granted that the three chromatic shades are named from their pykna and that the diatonic genus has no pyknon at all, still, it is nothing but confusing for the Aristoxenians to name the "normal" enharmonic configuration nothing at all, the "normal" chromatic configuration τονιαῖον (from interval size), and the "normal" diatonic configuration σύντονον (from its tuning).

σύντονος is still another technical term connected with the concept of "tuning," e.gg. ἀνίεται καὶ ἐκλύεται, μαλακόν, for the shades.

14.12-15.2 Cleonides now treats the second part of his discussion on shades by assigning numerical values to each interval. The system devised and employed by Cleonides and the Aristoxenians is quite ingenious and was no doubt of great pedagogical value, particularly in a world in which fractions were cumbersome to express. Here the tetrachord and all of its six formations are expanded to integer-terminology except for the recalcitrant hemiolic chromatic shade. The tetrachord, that is, a whole dia tessaron, contains thirty equal parts in this new configuration. Since a dia tessaron consists of two and one-half tones, one tone must be twelve parts, one halftone six parts, one quartertone diesis three parts, one trihemitone eighteen parts, and one soft chromatic third-tone four parts. With this terminology the two non-composite intervals of three dieses and five dieses in the soft chromatic shade can be expressed as nine parts and fifteen parts, and the large remainder of the soft chromatic which Cleonides had to express clumsily (see 12.15) becomes simply "21."

genus and shade (γένος καὶ χρόα)	verbal configuration	fractional configuration	integer configuration	total size
ἁρμονία	δίεσις, δίεσις, δίτονον	$\frac{1}{4} + \frac{1}{4} + 2$	γ γ κδ 3 + 3 + 24	30
μαλακὸν χρῶμα	δίεσις, δίεσις, τόνον ἡμιτόνιον τριτημόριον τόνου	$\frac{1}{3} + \frac{1}{3} + (1+\frac{1}{2}+\frac{1}{3})$	δ δ κβ 4 + 4 + 22	30
ἡμιόλιον χρῶμα	δίεσις ἡμιόλιος, δίεσις ἡμιόλιος, ἑπτὰ διέσεις	$\frac{3}{8} + \frac{3}{8} + \frac{7}{4}$	δϲ δϲ κα $4\frac{1}{2}$+ $4\frac{1}{2}$+ 21	30
τονιαῖον χρῶμα	ἡμιτόνιον, ἡμιτόνιον, τριημιτόνιον	$\frac{1}{2} + \frac{1}{2} + \frac{3}{2}$	ϛ ϛ ιη 6 + 6 + 18	30
μαλακὸν διάτονον	ἡμιτόνιον, τρεῖς διέσεις, πέντε διέσεις	$\frac{1}{2} + \frac{3}{4} + \frac{5}{4}$	ϛ ϑ ιε 6 + 9 + 15	30
σύτονον διάτονον	ἡμιτόνιον, τόνον, τόνον	$\frac{1}{2} + 1 + 1$	ϛ ιβ ιβ 6 + 12 +12	30

The only difficulty in this system appears in the hemiolic chromatic configuration. Four and one-half is by no means an integer, and the whole system loses some of its integrity and pedagogical value as a result; one-half, of course, is the easiest fraction which one can manipulate. To correct this defect the Aristoxenians would have had to increasethe number of parts in the dia tessaron from thirty to sixty. Then a whole tone would be twenty-four, a halftone twelve, a quartertone six, a third tone eight, and a hemiolic diesis nine. By using these numbers the system would consist only of integers, and the integers would be the lowest possible integers:

enharmonic:	6 + 6 + 48 = 60 (ϛ, ϛ, μη)
soft chromatic:	8 + 8 + 44*= 60 (η, η, μδ)
hemiolic chromatic:	9 + 9 + 42 = 60 (ϑ, ϑ, μβ)
tonic chromatic:	12 + 12 + 36 = 60 (ιβ, ιβ, λϛ)
soft diatonic:	12 + 18 + 30 = 60 (ιβ, ιη, λ)
syntonic diatonic:	12 + 24 + 24 = 60 (ιβ, κδ, κδ)

*44 = 24 + 12 + 8

This is the numerical system used by Aristides (17.21-18.4). (Could this serve as evidence that Aristides postdated Cleonides?) The Pythagoreans have quite a different method; cf. Ptolemy 1.12-16 and Bryennius 114.15-32.

C reads the singular δείκνυται, but the subject is clearly the feminine plural χρόαι. The many variants for ἀριθμῶν pose a much more insoluble problem. The variety is indicative of the complexity of the Greek language, for all the variants mean "through, by number." δι' ἀριθμῶν (P), ἀριθμῷ (ZQ), ἐν ἀριθμῷ (C^1) all seem possible, and with P's δι' ἀριθμῶν one must connect the ἀριθμῶν of M. The simple

genitive cannot at all be correct, for it modifies nothing; "shades of the numbers" is nonsense. When one checks the parallel passage in Aristides (17.22) he will find much to his dismay ἐπ' ἀριθμῶν. Nicomachus, in a non-parallel passage (244.10), offers ἀριθμῷ πάντα οἰκονομεῖται ταῦτα and (245.19 and 250.9) κατ' ἀριθμόν. Ultimately the choice is between ἀριθμῶν(ZQ) and δι' ἀριθμῶν (P), for the others are awkward. P, of course, preserves an early and excellent version of the treatise; Z is far inferior and yet not without the capacity for conjecturing competently. Following Nicomachus' ἀριθμῷ one might print the same in this treatise, but only with the security that he is preserving Cleonides' sense, not necessarily his exact expression.

14.20 Many of the manuscripts preserve the numbers in this passage in their alphabetical symbols. Jan prints these symbols inconsistently, but the manuscripts are not consistent either. I offer all numbers in the "prose" format, for I believe it much more likely that prose would yield to Byzantine symbols rather than vice versa. The same is true for the occasional manuscript abbreviations for words such as τρίτη and διὰ πέντε (Γ̄ and δια ε̄).

15.3 Cleonides begins his discussion of systems (15.3-24.5), his fourth topic for discussion. He uses the same format with which he introduced the discussion on intervals, i.e. by listing their differences. Here, however, there are seven differences in systems--size, genus, consonance, rationality, consecutiveness, conjunction or disjunction, and changeability or immutability. The first four again resemble the discussion on intervals because in a sense systems are glorified intervals. Compositeness is missing, however, for sys-

tems are by definition composed of more than one interval, and two intervals together necessarily form two smaller non-composite intervals and one larger composite interval. See Bryennius 104.1-4.

The last three differences are unique to systems; each of these differences will be discussed at the appropriate place in the commentary. The discussion of systmes is by far the longest in the treatise. Cleonides organizes this lengthy passage into eight parts: 1) an introductory sentence (15.3-9) and one for each difference between systems, 2) size (15.9-12); 3) genus (15.12-13); 4) consonance and dissonance (15.14-21.3); 5) rationality and irrationality (21.4-7); 6)consecutiveness and non-consecutiveness (21.8-10); 7) conjunction and disjunction (21.11-23.13); and 8) the ability or inability to modulate (23.14-24.5). The introductory sentence and four of the differences follow Cleonides' regular pattern. The discussion of consonance and dissonance, however, is greatly expanded to include a discussion of the six (plus two) consonances, and then a discussion of the figures (σχήματα) of these consonances (17.4-21.3). The discussion of conjunct and disjunct systmes finally offers to the reader a look at tetrachords (21.11-22.9) and then a brief description of the two perfect systems (22.10-23.7) and the ametabolic system (23.8-23.13).

For parallels, see Aristoxenus 22.3-23.8, Bryennius 1.6 (the same seven differences), Aristides 1.8, Bacchius #5, 11-18, 28-29, Gaudentius #4, Nicomachus #12, [Ptolemy] #24, Anonymous Bellermann #23, Ptolemy 2.4, Porphyry 162-63, [Plutarch] 1142 F, Philo Mech.Bel. 1.10, Martianus Capella, and Michaelides "Systema" 316-20.

σύστημα, like τόνος, φθόγγος, and διάστημα, is a term extremely fundamental to Greek musicology and a sine qua non to its more elaborate structures. The word σύστημα refers to any composite whole (from συν- and ἵστημι; cf. διάστημα from διά and ἵστημι). Its meanings are almost entirely technical, whether used in discussing literature (Arist. Po. 1456^{a}11), government (Pl. Leg. 686 B), religion (Strabo 17.1.29), medicine (Hp. Epid. 7.83), or music. Plato (Phlb. 17 D) already uses the term in its technical sense.

15,5 Cleonides uses the κατὰ plus noun construction for κατὰ μέγεθος καὶ ἡ κατὰ γένος but then abandons it in favor of the simple genitive of the adjective.

Jan, who usually follows or at least reports the readings in M with such zeal, neglected the manuscript here. In the margin after συμφώνου a second hand (M^{1}) has squeezed in καὶ διαφώνου, the logical accompaniment to τοῦ συμφώνου; cf. 9.5 and 9.12f. Elsewhere in this sentence Jan completes all parallels (e.g. τοῦ ῥητοῦ καὶ ἀλόγου, τοῦ ἑξῆς καὶ ὑπερβάτου), and when Cleonides picks up the actual discussion of systems differing in terms of consonance and dissonance (15.14f.), he uses the phrase τοῦ συμφώνου καὶ διαφώνου. The pattern is clear and the phrase should be included in the text.

15.9 Systems differ in size, just as do intervals. The examples which Cleonides offers, the octave and tritone, or fifth, or fourth, differ in size in that the octave is larger than the other systems--six (Aristoxenian) whole tones to three, to three and one-half, to two and one-half, respectively. All these intervals are systems if they are composite, by definition.

15.11 Jan and Menge both print διαπέντε here as one word; there is only weak manuscript support for this form of the term, and this is the only occasion in which they print the interval in this way.

15.12 Cleonides discusses briefly the second difference between systems--genus. It is interesting to note how Cleonides wording here differs from that in the parallel passage at 9.10-12 on genus and intervals. Cf. also 15.9 and 9.6.

Γένη (MC) has strong manuscript support, but the sense indubitably requires a dative of cause (cf. μεγέθει (15.9 and τῇ διοίσει (15.14)), and the error is easily traceable to iotacism.

15.13 The τα which Q adds before ἐναρμονία is not necessary. Cleonides omitted the article before χρωματικῶν in this line--a close parallel to this word, and he often drops the article after the first noun of a series.

τῶν λοιπῶν: a brief way of saying τὰ χρωματικὰ τῶν διατονικῶν ἢ ἐναρμονίων, ἢ τὰ ἐναρμόνια τῶν διατονικῶν ἢ χρωματικῶν.

15.14 Cleonides now discusses the third difference in systems--consonance and dissonance (τοῦ συμφώνου and τοῦ διαφώνου). This particular discussion of the difference between consonant and dissonant systems will not be brief. The discussion evolves from the listing of the six consonances with examples of each (16.2-16.16), a brief digression on the four consonances in the conjunct system (16.16-16.20), a return to the seventh and eighth consonances (16.20-17.2), a brief mention of the dissonances (17.2-3), and then a lengthy discussion of the species or systems (17.4-21.3). Cleonides first de-

fines these, describes them for the dia tessaron, dia pente, and dia pason in all three genera. Then he finally arrives at the next difference in systems--rationality and irrationality (21.4).

The syntax here seems complex only because of the omissions of διαφορᾷ and συστήματα. Z supplies the unnecessary διαφορᾷ ὁμοίως. Cf. the ample parallels at 21.4-5 and 21.8-9, 11-12.

Cleonides' statement that systems are bounded by "consonant notes" (συμφώνων φθόγγων) means "by two notes, which, when sounded together, are consonant." This distinction must be added since a note is not consonant; intervals are consonant and therefore two notes with an interval between them can be consonant.

16.2 Cleonides discussed earlier (9.12-19) the consonances, but there he merely defined the term and gave examples. In this passage he lists all six, for the consonant systems represent all the possible larger structures of and within the ametabolic system.

16.3 Cleonides uses ἐλάχιστον for the first consonance, not πρῶτον. For the rest of the series he uses δεύτερον, τρίτον, κ. τ. λ. His use of ἐλάχιστον should remind us that Cleonides will not always offer a strict, logical, predictable employment of words.

The dia tessaron is the smallest consonance and the consonance upon which all the larger constructs of Aristoxenian musicology are based. Cleonides gives only one example--hypate hypaton to hypate meson; these notes are fixed, and so this particular dia tessaron will be the same in all three genera (and all six shades). Other examples he might have given are parhypate hypaton to parhypate meson, lichanos hypaton to lichanos meson, and hypate meson to mese. It does not

matter which genus is used so long as the same genus is used in forming both "ends" of the dia tessaron. In each genus there are eight possible dia tessaron systems in the two-octave system.

16.5 The dia pente, an interval of three and one-half tones, is the second consonance. It exceeds by one tone the size of the dia tessaron, and so proslambanomenos to hypate meson is a very illustrative example; proslambanomenos is one tone lower than hypate hypaton.

16.6 C^1 here adds και before ἡμίσεος. There are four places where the phrase και ἡμίσεος possibly appears: 16.4 (with διὰ τεσσάρων); 16.6 (with διὰ πέντε), here; and 16.13 (with διὰ πασῶν καὶ διὰ πέντε). At all four locations the interval of the consonance involves several whole tones plus one halftone. Only at 16.10, however, do the manuscripts fully support the addition of καὶ; elsewhere they are inconsistent. The same is true for ἡμίσεος vs. ἡμίσους. ἡμίσεως and these two forms were interchangeable in later Greek authors, and since ἡμίσεος has more widespread manuscript support, I print it in my text throughout.

16.7 The third consonance is the octave or dia pason. The name διὰ πασῶν obviously derives froman era in which the most prevalent music consisted of a fundamental octave, not a two-octave system. The dia pason is equivalent to the sum of the first two consonances--the dia tessaron and dia pente, or two and one-half plus three and one-half, or, six whole tones. The Pythagoreans, Euclid included, reckoned the dia pason as being just less than six tones; cf. Euclid #9, 14; Ptolemy 1.10, Plutarch De animae procr. in Tim. 1020 E-F; Pachymeres 459, Gaudentius #14; A. E. Chaignet, Pythagore et la Philosophie Pythagorici-

enne (Paris 1873) I 231; and Michaelides "Apotome" 26 and "Leimma" 184. Cleoindes gives an an example proslambanomenos to mese; he might also have given hypate hypaton to paramese, parhypate hypaton to trite diezeugmenon, lichanos hypaton to paranete diezeugmenon, etc., in all three genera.

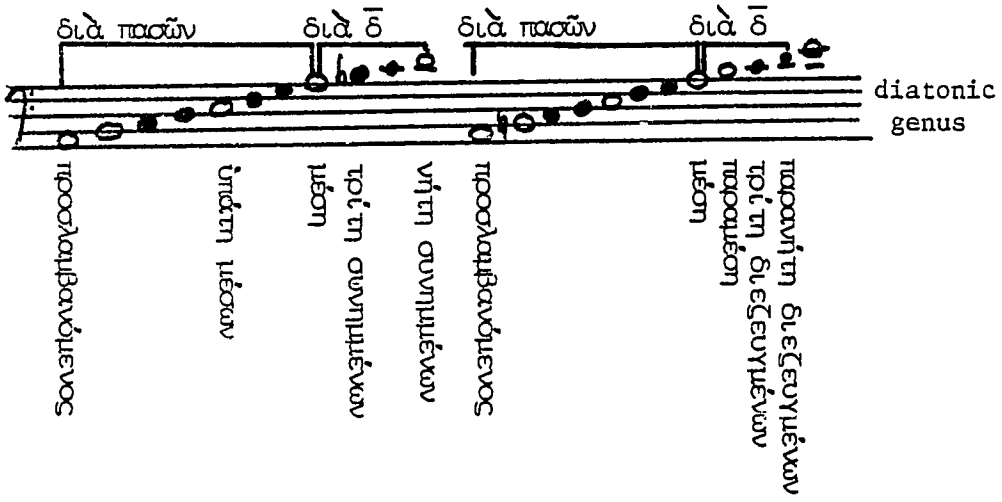
16.9 The Pythagoreans did not consider the dia pason and dia tessaron (eleventh) to be a consonance, for its arithmetical proportion (8:3) was imperfect; cf. infra 9.12.

Cleonides now repeatedly makes proslambanomenos the lowest note in his examples. The dia pason and dia tessaron has two different upper boundaries, however. Nete synemmenon is situated one dia meson (mese) plus one dia tessaron above proslambanomenos; diatonic paranete diezeugmenon is situated at the same pitch, except that nete diezeugmenon ascends a dia tessaron directly from the mese while diatonic paranete diezeugmenon ascends one and one-half tones after the whole tone interval between mese and paramese. This consonance would not be found in the enharmonic and chromatic genera in that paranete diezeugmenon there would have pitches of c and c♯, respectively and would not form consonances with proslambanomenos. With nete synemmenon, on the other hand, a fixed note, there is no difficulty in any genus. See the schema found on the following page.

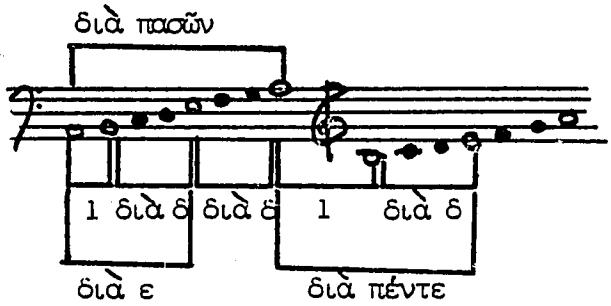
16.10 For καί (MCP), see supra, n. 16.6.

16.11 Z has μέσων for συνημμένων, but the interval from proslambanomenos to nete synemmenon is the proper size--eight and one-half tones. Cleonides does not use any such terminology as νήτη μέσων.

Two upper boundaries for the διὰ πασῶν καὶ διὰ τεσσάρων:



16.12 The fifth consonance is διὰ πασῶν καὶ διὰ πέντε (twelfth) and ranges from proslambanomenos to nete diezeugmenon. The whole tone interval from mese to paramese serves as the upper octave equivalent to the whole tone interval from proslambanomenos to hypate hypaton in the lower octave; this lower whole tone interval is that which Cleonides used to form the dia pente. The dia pason from proslambanomenos to mese is composed of a dia pente (proslambanomenos to hypate meson) plus a dia tessaron (hypate meson to mese). Similarly, the upper dia pason has parallel consonances at the nete point of the diezeugmenon and hyperbolaion tetrachords, the fifth ranging from mese to nete diezeugmenon, the dia tessaron from nete diezeugmenon to nete hyperbolaion.



16.14 The sixth and largest consonance in the ametabolic system is the double octave (δὶς διὰ πασῶν), consisting of two octaves ranging the entire length of the system from proslambanomenos to nete hyperbolaion.

All six consonances could be diagrammed in this way to show their progression. The diagram could also contain more of the smaller consonances, e.gg. numerous dia tessarons, eight dia pasons, etc. But the rest of the locations of these consonances are called "figures," and Cleonides discusses them at 17.4f.

1 ½ 1 1 ½ 1 1 1 ½ 1 1 ½ 1 1 intervals

16.16 $M^{ac}CP$ omit τὸ δὲ συνημμένων σύστημα πρόεισι μέχρι, but the strong manuscript support for this omission apparently resulted from a similar omission in the lost prototype. τέταρτον συμφώνου simply cannot stand by itself. M^{1}'s correct reading here should be taken into account when evaluating 13.8.

Cleonides has mentioned (16.2-3) that he was going to discuss the six consonances in the ametabolic system. Now he turns to part of the ametabolic system--the lesser perfect or conjunct (συνημμένων) system. The conjunct system (σύστημα συνημμένον) is the system which

includes the synemmenon tetrachord and eliminates the diezeugmenon and hyperbolaion. The σύστημα συνημμένον has only the following (first) four consonances--dia tessaron, dia pente, dia pason, dia pason and dia tessaron; cf. the schematization on p. 280 (top)--the first half of the diagram.

It should be clear, though Cleonides does not specify this, that these consonances in the perfect systems fall most neatly on the fixed notes. This is not to say that a consonance cannot fall on a movable note; it can and frequently does as Cleonides will show when discussing the figures (17.4f.). But the perfect systems are securely structured upon these constant fixed bases which form the various consonances, and it is a credit to Cleonides' organization that he limits himself to the fixed notes here and then adds the movable notes later.

Jan brackets the whole passage on the conjunct system, τὸ δὲ συνημμένον --τεσσάρων (16.20), but the manuscripts without exception--despite the erroneous report in Jan's apparatus--have transmitted this passage. MCP omit the first six words of the passage, but this partial omission would not at all help to justify the absence of the remainder.

16.17 Cleonides might have added καλούμενον (U) since he finds himself trying to explain a term --συμφωνία--by using another term--συνημμένου--which he has not yet explained. Sometimes Cleonides finds the exclusion of future material impossible, for he did not hesitate to expose the reader prematurely to ἀμετάβολον in 15.8 and 16.2; but in neither passage did he feel any compunction to add καλούμενον. More importantly, the addition of καλούμενον would suggest that Cleonides had some reservations about using the name συνημμένον to describe this

system; in fact, when Cleonides does discuss this system in greater detail at 22.10-16 he does not call this system τὸ συνημμένον σύστημα or τὸ συνημμένον καλούμενον σύστημα, but τὸ ἔλαττον τέλειον σύστημα (or "lesser perfect system"). Nonetheless, U is not a reliable manuscript; the word should not be printed even if the scribe of U has indirectly pointed out a loose end in Cleonides' pedagogy.

N adds a one word scholion, δεκάχορδον, but the dekachord (Aristides 14.3-6) consisted of ten notes, not ten intervals; the consonance in question here consists of eleven notes (ten intervals). The word is not found elsewhere in the musicologists.

συνημμένον (from συνάπτω) is not found earlier than the fifth century. Other than the non-scientific uses of "to join together," the word was used by logicians to mean "hypothetical" and by mathematicians (Archim. Sph. Cyl. 2.4) to mean "compounded of"; Nicomachus (Ar. 2.21) uses the phrase συνημμένη μεσότης to signify "geometric" mean." The musicologists' use of the word to describe the conjunction of two tetrachords seems to resemble more closely the original meaning of the word; cf. [Plutarch] 1029 A, 1137 C.

16.18 Early on in the tradition a scribe apparently mistook γὰρ ἐν αὐτῷ for a form of γράφειν.

M omits τέταρτον τὸ διὰ πασῶν which decreases a four-consonance system to a three consonance system by omitting the dia pason, an impossiblility. But the omission is representative of errors to be made frequently in the following forty lines. Many phrases will have similar constructions, i.e. ordinal adverb...particle...ordinal adjective..prepositional phrase, with only slight

variation; see, for example 18.5-6. Such phrasing would give the scribes much opportunity for omission, duplication, and rearrangement.

16.20 U's addition of the fifth and sixth consonance is erroneous. Cleonides stated quite clearly that this second listing of the consonances (16.16-20) was to describe only the four consonances contained in the lesser perfect or conjunct system.

Although the great systems of Greek musicology never extend beyond the sixth consonance of the double octave in any of our sources, a few musicologists did at least recognize a seventh and eighth consonance. Cleonides admits that the range of the voice (τόπος φωνῆς) can reach up to the eighth consonance--the double octave plus another fifth (δὶς διὰ πασῶν καὶ διὰ πέντε). In calling this the eighth consonance Cleonides clearly implies that the seventh consonance is the other combination he mentions here, the double octave plus dia tessaron (δὶς διὰ πασῶν καὶ διὰ τεσσάρων). These consonances reach quite a bit higher than any Cleonides has discussed so far; but we do not hear of names for any tetrachords above hyperbolaion. In fact, we do not even know if these tetrachords are conjunct or disjunct with nete hyperbolaion.

Aristoxenus (25.15-27.3) has a most illuminating discussion of these consonance; he recognizes consonances of two octaves plus a dia pente, three octaves, and four octaves. In fact, he continues, any consonance plus another dia pason will produce a consonance (25.18-26.1). On the other hand, Aristoxenus regards the double dia pason and dia pente as the highest "practical" consonance (26.1: κατὰ τὴν ἡμετέραν χρῆσιν. The τρὶς διὰ πασῶν is "beyond our reach" (26.6: οὐκ ἔτι διατείνομεν), Larger consonance can be made between a high-pitched

aulos and a low-pitched aulos, or between the voice of a child and that of an adult, but those larger consonances are without musicological purpose. Aristoxenus concludes by saying that the largest consonance is to be determined by usefulness (δυνάμει) and that there are therefore eight of them ranging from the dia tessaron to the δὶς διὰ πασῶν καὶ διὰ πέντε. See also J. Cook Wilson, "Pseudo-Euclid, Introductio Harmonica" CR 18 (1904) 150-51.

16.21 MCP all omit δὶς here, as they do in 17.1; δὶς is clearly needed, and it is easily confused by the scribal eye with the juxtaposed διὰ.

17.2 The dissonant systems are all those either smaller than the dia tessaron or between the consonances already mentioned by Cleonides. By definition a single non-composite diesis, e.g. from hypate hypaton to enharmonic parhypate hypaton, could not be considered a dissonant system, for a system must have more than one interval. The composite halftone from hypate hypaton to enharmonic lichanos hypaton could be a dissonant system, for it is composed of more than one interval, and the entire system is smaller than a dia tessaron; the dia tessaron is the first and smallest consonance. A system of a composite ditone, e.g. from proslambanomenos to chromatic lichanos hypaton would also be dissonant, as would a composite trihemitone from hypate hypaton to diatonic lichanos hypaton. An example of a dissonant system between the consonances would be a system that ranged a pentatone from proslambabomenos to diatonic lichanos meson which is larger by one and one-half tones than a dia pente (three and one-half tones) but smaller by a tone than a dia pason.

Dissonances should not always be thought of as ranging only in whole tones. Another system could be three and three-quartertones in size spanning from proslambanomenos to enharmonic parhypate meson. Since the number of consonances is theoretically infinite, so is the number of dissonances.

17.4 The lengthy discussion of figures (σχήματα, εἴδη) of the consonant systems begins here and ends at 21.4 where Cleonides returns to his fourth difference in systems. Now that the six consonances have been defined, Cleonides can show what various forms each consonance can take. The dia tessaron of two and one-half tones from hypate hypaton to hypate meson ascends (in the diatonic) by halftone, whole tone, whole tone. The same consonant system of the dia tessaron, i.e. two and one-half tones, also exists between parhypate hypaton and parhypate meson, but it is formulated by adding whole tone, whole tone, halftone. The dia tessarons are therefore equal in overall size and in the number of intervals (three) and in the size of the intervals, but they differ in the arrangement of these three intervals and in their locus in the two-octave system, that is, in relative pitch. Cleonides is not interested in pitch, however, for he has not yet described the ametabolic system.

Cleonides mentions these three topics in his two introductory sentences, which suggest, that if there is a dissimilarity between two systems (ἐνυπάρχοντός τινος ἀνομοίου), and if these two systems have the same number of intervals (ἀριθμοῦ), and if these two systems have within them the same non-composite intervals (ἐκ τῶν αὐτῶν ἀσυνθέτων), then this dissimilarity will exist in the σχήματα which will be of

equal size for both systems (τοῦ αὐτοῦ μεγέθους). If, on the other hand, the figures, that is, the order within the two intervals, are alike (ὁμοίων σχημάτων), and if the size and number of the intervals are the same, then the two systems will be exactly the same. If two systems differ in size (τοῦ αὐτοῦ μεγέθους) or number of intervals (ἀριθμοῦ), then they will have a relationship to each other as estranged as the dia tessaron and dia pente. The former interval has a size of two and one-half tones, the latter of three and one-half tones; the former consists fo three intervals (two whole tones, one halftone), the latter of four intervals (three whole tones, one halftone). If they have the same number of intervals, however, and have the same overall size, they may still differ (ἐνυπάρχοντός τινος ἀνομοίου) and this difference must be in the internal arrangement of the intervals (ἡ τάξις ἀλλοίωσιν λάβοι). But these different arrangements will still maintain the present size of the interval.

For parallels in other musicologists, see Aristoxenus 92.6-17 (who equates σχήματα and εἴδη); Anonymous Bellermann #2; Ptolemy 2.19; Nicomachus 275; Bacchius #11, 27, 75; Gaudentius #18; Aristides 14.27-15.20; Bryennius 104.25-108.19 (after Cleonides); and cf. Arist. Pol. 1276 and [Plutarch] 110 E. Aristoxenus 92.9f. is the source of Cleonides' introductory sentence.

Ptolemy (Tetr. 21) uses σχῆμα as a "phase" of the moon, and Plato (Ion 536 C) as a "figure" of speech. It is used rather sparingly as a musical term despite its omnipresence in the other learned disciplines.

Cleonides organizes his discussion carefully. After the introductory sentence already discussed (17.4-8), he then describes the

three figures of the chromatic and enharmonic dia tessaron and gives an example for each (17.8-15); the three figures of the diatonic dia tessaron (18.3-8) preceded by a mthodological digression differentiating the structure of the diatonic genus from that of the chromatic and enharmonic (17.15-18.3); the four figures of the chromatic and enharmonic dia pente (18.9-20); the diatonic dia pente (18.20-19.3); the seven figures of the dia pason for the chromatic and enharmonic (19.4-20.13) with an example for each and a "geographical" name for each; and the seven figures of the dia pason for the diatonic genus (20.14-21.3).

17.5 συγκειμένων is supported by the better manuscripts (MCP) though it clearly resulted from attraction to the genitive plural endings on τῶν αὐτῶν ἀσυνθέτων. To have συγκειμένων modify διαστημάτων would be to suggest that "intervals" are "composed of the same non-composite intervals," which is nonsense. Making a genitive absolute will not work either; all systems by definition are composed of non-composite intervals, and genitive absolutes usually have their nouns present within them. Reading συγκειμένων would also render the construction of ἀριθμοῦ quite obtuse. Z perhaps saw this and wrote ἀριθμοί, but numbers are not the subject under discussion; they are simply one permanent aspect of the figures.

17.6 The omission of εἰ by C is not compelling. Without εἰ the optative in λάβοι would be less than welcome in a pedagogical treatise. The εἴπερ transmitted in C^1P^1 resulted probably from a gloss intrusion.

λάβοιεν ὑπάρχοντος (for λάβοι ἐνυπάρχοντος) reveals a clear example of improper word division (MCP) in an archetype; λάβοιεν has a singular subject (τάξις). and so it must be the singular verb form.

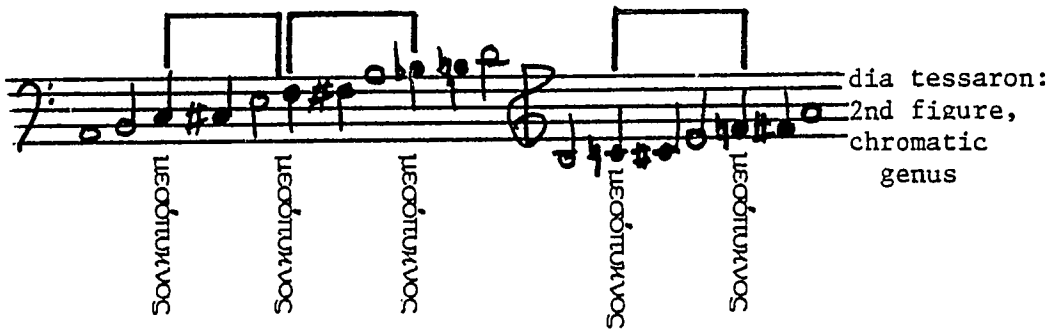
17.8 Finishing his brief introductory remarks, Cleonides now proceeds to specific examples. First he lists the three figures--now using the word εἴδη instead of σχήματα--for the dia tessaron. Though he never really informs us as clearly as we might wish, Cleonides does not tell us until later (17.16f.) that these figures are for the chromatic and enharmonic genera only; he will describe the diatonic genus' figures later (17.17f.). The two types of figures, those of the chromatic and enharmonic and those of the diatonic, are formed in essentially the same manner. The difference lies only in the terminology, for the chromatic and enharmonic figures are described in terms of the pyknon while the diatonic, of course, has no pyknon (8.14).

17.9 The first σχῆμα of the dia tessaron for the enharmonic and chromatic genera lies between the barypyknoi. These barypyknoi could be any consecutive pair of hypate hypaton, hypate meson, mese, nete synemmenon or or paramese, nete diezeugmenon, nete hyperbolaion. All stand a dia tessaron apart and all are barypyknoi; but nete synemmenon and nete hyperbolaion are not really barypykna in the coniunct and disjunct perfect systems; they merely bound the system and are thereby apyknoi. To this extent Cleonides' definition is unclear. This first figure has the same internal progression of intervals(½ + ½ + 1½ and ¼ + ¼ + 2)as the "normal" chromatic and enharmonic tetrachords described at 3.15-4.3.

ὑπό (CP) and/or ἀπό (M) are used in the same construction in all the examples here (17.9, 11, 13; 18.10, 12, 15, 17; 19.5, 8, 11, 14; 20.3, 7, 10). Only at 17.9 do any of the manuscripts (M) err.

17.11 The second figure is bounded by the mesopyknoi, and it ac-

cordingly sits one halftone in pitch higher than the barypvknoi-bounded first figure. But pitch is of no real concern here: relative pitch would be measured bv notes' positions in the metabolic system, and this svstem itself moves within itself by the various tones--its own grand form of σχῆμα. Again, Cleonides select the lowest possible example. In the two-octave system, only three examples of this form of dia tessaron can be found in each genus despite the fact that there are five mesopyknoi (just as there were five barypyknoi for the five figures of the first figure. It is not the number of each one of these figures with which Cleonides is concerned; it is only the relationships of the intervals within the figures. The second figure of the enharmonic and chromatic dia tessaron has the construction: ¼ + 2 + ¼ and ⅓ + 1⅓ + ½.



ὑπάτων (MP) is by attraction; there is no single note ὑπάτων μέσων,

17.13 The third figure is bounded by oxypyknoi. Here the construction is (enharmonic) 2 + ¼ + ¼ and (chromatic) 1½ + ½ + ½.

All three types of figures of the dia tessaron for the chromatic and enharmonic genera can be diagrammed as follows:

CHROMATIC GENUS: DIA TESSARON FIGURES

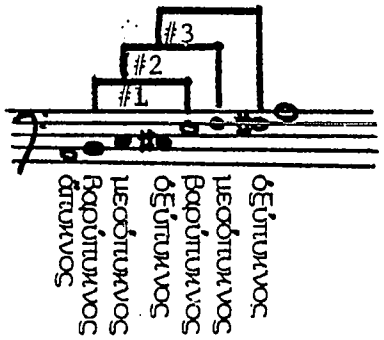


fig. 1: ½ ½ 1½

fig. 2: ½ 1½ ½

fig. 3: 1½ ½ ½

ENHARMONIC GENUS: DIA TESSARON FIGURES

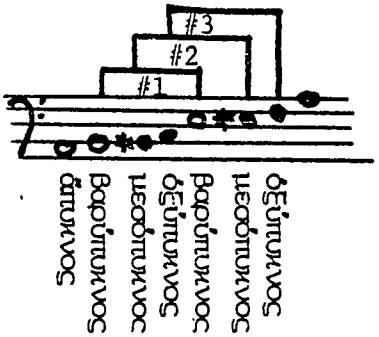


fig. 1: ¼ ¼ 2

fig. 2: ¼ 2 ¼

fig. 3: 2 ¼ ¼

MC have ὑπάτων for παρυπάτην, the result of omission (παρ-) and attraction (-ων μέσων). μέσον (17.15 MC) is also the product of attraction (λιχανὸν μέσον).

17.15-18 The forms are not "calculated (λαμβάνεται) by the condition of the pvknon" in the diatonic because the diatonic has no pyknon. Instead, one must discuss the diatonic genus in terms of its one halftone and two whole tones. These correspond to barypyknos, mesopvknos, and oxypyknos, e.g. the note beneath the halftone in the "normal" diatonic configuration would be the equivalent to a bary-

17.16 σχέσις essentially means "state, condition," but philosophers and grammarians (and metricians) used it to mean "relation, relationship" (LSJ I.4).

τῶν συμφώνων: sc. συστημάτων.

17.19-18.2 Cleonides expands upon the formulations that he has already given when he discussed the sizes of the consonances at 16.3-9. I find it odd here that Cleonides describes the dia pason as made not of six (Aristoxenian) whole tones, but of five whole tones and two half tones.

17.20 The adjectival τονιαῖα (MC) is less desirable than the more common noun τόνοι. Also, τόνοι is used in the parallel sentences at 18.1 and 18.2.

18.2 The forms (εἴδη) of the diatonic consonant systems are described by locating the halftone. By relating this lone halftone to the top, bottom, or middle of the system Cleonides can derive the various figures.

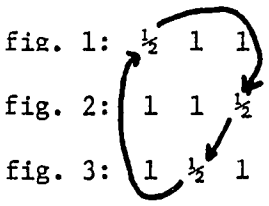
18.3 The first figure of the diatonic dia tessaron has the "normal" configuration, i.e. ½ + 1 + 1. As with the first figure of the chromatic and enharmonic genera (bounded by barypyknoi) this first figure of the diatonic genus has five locations within the two-octave system. In fact, since all notes involved here are fixed notes, the figures of all three genera are the same. It should be evident that Cleonides recognized this similarity since he does not trouble to repeat the examples which he gave when describing the figures of the chromatic and enharmonic.

18.5 The second form of the diatonic dia tessaron again has only three examples in the two-octave system despite the presence of five tritai and parhypatai (equivalents of mesopyknoi) in the two-octave system. The formulation here is 1 + 1 + ½.

U simply reverses the positions here and makes nonsense of the phrase.

18.6 The third figure of the diatonic dia tessaron locates the halftone between the two whole tones. The formulation of this third figure is 1 + ½ + 1.

All three forms of the diatonic dia tessaron overlap and proceed in a fashion similar to the three forms of the chromatic and enharmonic dia tessaron; cf. supra. p. 291. Again as with the other two genera, the mathematical configurations seem to have a circular motion if one follows the course of the halftone:



ταῦτα: sc. εἴδη or σχήματα.

18.7 For a scribe to have confused the dative neuter plural of γένος with the accusative feminine singular of γένεσις (M^1) was a common enough type of error in medieval Christendom; see M. L. West, Textual Criticism and Editorial Technique (Stuttgart 1973) 18.

18.9 Proceding from the smaller to the larger systems, Cleonides now discusses the four forms of the dia pente, again beginning with the chromatic and enharmonic genera and following with the diatonic.

His diction does not remain the same. For the dia tessaron figures he had written the number of the figure, particle, τὸ ὑπὸ the note in the pvknon περιεχόμενον, οἷόν ἐστι τὸ ὑπὸ example ἐπὶ example; now he changes οἷόν ἐστι τὸ to οὗ number ὁ τόνος ἐπὶ τὸ (ὀξύ/βαρύ). He makes this change since the simple employment of barypyknoi. mesopvknoi, and oxypyknoi can occur only in the dia tessaron. Cleonides cannot use these terms exclusively in describing the forms of the dia pente because he will not be able to limit the figures to just one location; locating the tone by relative position allows him to be more specific.

The first figure of the dia pente is bounded by the barypyknoi, and the whole tone is situated as the first interval at the top. Cleonides' example is not again at the lowest possible location; it is at the only possible location, for the only whole tones in the chromatic two-octave system lie between proslambanomenos and hypate hypaton. and between mese and paramese. The whole tone between proslambanomenos and hypate hypaton can serve as the first interval in a chromatic dia pente, but not in this figure where the tone must be the highest interval.

There is only one whole tone in the chromatic dia pente system, and it lies outside the chromatic tetrachord in this figure. the formulation being ½ + ⅓ + 1⅓ + 1.

The first figure of the enharmonic dia pente system has the same (and only one possible) location, its formulation being ¼ + ¼ + 2 + 1.

These chromatic and enharmonic figures will not fit into the conjunct system since the conjunct system does not contain the

necessary whole tone.

The difference between this figure (and the remaining figures of the dia pente) and those of the dia tessaron results from the whole tone. All the figures of both dia tessaron and dia pente range consecutively from barypyknos to barypyknos, mesopyknos to mesopyknos, and oxypyknos to oxypyknos. But the dia tessaron figures have no whole tone in their midst and each figure can be located in as many as three or five areas of the two-octave system. The dia pente figures do have the internal whole tone, and so each figure must surround the lone whole tone in the two-octave system--between mese and paramese, except in the last figure where the tone can also be at the bottom (proslambanomenos to hypate hypaton); cf. <u>infra.</u> n. 18.17.

18.12 The second figure of the chromatic and enharmonic dia pente system is bounded by mesopyknoi and the whole tone is the second highest interval. Again, the synemmenon system does not apply. The numerical formulations here are:

chromatic: ½ + 1½ + 1 ½

enharmonic: ¼ + 2 + 1 + ¼

18.14 The third figure of the chromatic and enharmonic dia pente system is expectedly bound by oxypyknoi and locates its whole tone as the third highest interval. The lone example in the two octave system falls between lichanos meson and paranete diezeugmenon. The formulation here is this:

chromatic: 1½ + 1 ½ + ½

enharmonic: 2 + 1 + ¼ + ¼

18.17 The fourth and last figure of the chromatic and enharmonic

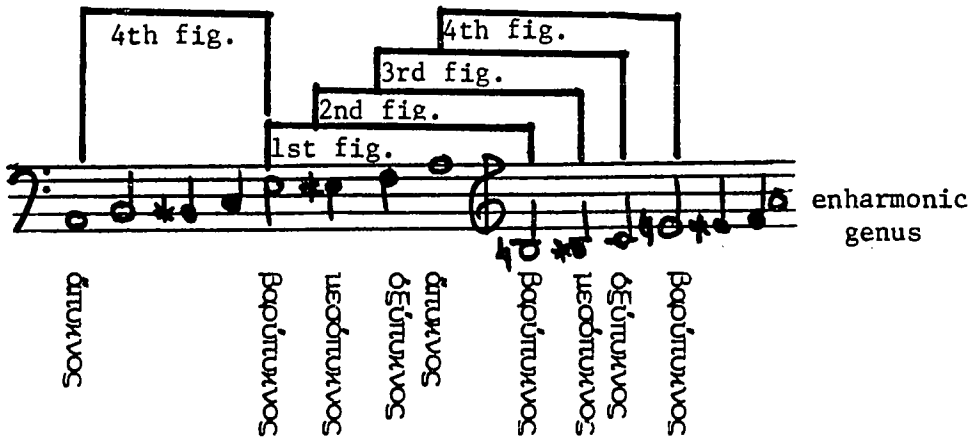
dia pente system has two possible locations since the whole tone finally rests at the bottom of the figure; the whole tone between proslambanomenos and hypate hypaton can now fit into a dia pente. Cleonides gives both possibilities as examples--this and mese to nete diezeugmenon. As with the first figure, this one is bounded by barypyknoi but the location of the whole tone makes the figures differ in their formulation:

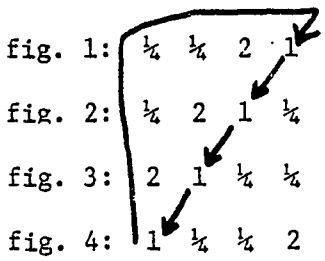
chromatic: $1 + \frac{1}{2} + \frac{1}{3} + 1\frac{1}{2}$

enharmonic: $1 + \frac{1}{4} + \frac{1}{4} + 2$

The "barypyknoi" here are actually a combination of barypyknoi (hypate meson and nete diezeugmenon) and apyknoi (proslambanomenos and mese). Apyknoi were also found to be included in those notes bounding the first figure of the dia tessaron (chromatic and enharmonic). The synemmenon system will also fit here since the whole tone is now in the first postion.

The four figures of the chromatic and enharmonic dia pente system can be diagrammed as follows. As with the dia tessaron figures, one can see the circular motion of the formulations in the orderly progression of the figures.





Only U reads δὲ after τέταρτον, but all the other sentences which begin similarly each have (μὲν) δὲ (πρῶτον μὲν 18.9f.; δεύτερον δὲ 18.12; τρίτον δὲ 18.14). There is no evident reason for Cleonides to have omitted the particle in this sentence only; he does omit it entirely after the ordinals in 19.8 (except LQ), 11, 14; 20.3, 7, 10, but the series here and there should remain internally unified.

18.18 All of the manuscripts have οὐ τέταρτος ὁ τόνος ἐπὶ τὸ βαρύ, but Jan, making a parallel for the related diatonic figure (19.3) read οὐ πρώτος ὁ τόνος (ἐπὶ τὸ βαρύ); Menge omits the parentheses. It is true that τέταρτος will not make sense when used with ἐπὶ τὸ βαρύ, for the fourth interval from the bottom equals the first from the top, and this location would form the first figure. To make sense musically, the phrase has to be either the fourth from the top (τέταρτος...ἐπὶ τὸ ὀξύ) or the first at the bottom (πρώτος...ἐπὶ τὸ βαρύ). Jan prints the latter alternative with no manuscript support, only internal parallels. Paleographically, τέταρτος...ἐπὶ τὸ ὀξύ (M^1?)is probably the better reading. It would have been much easier for a scribe to confuse βαρύ and ὀξύ (cf. 20.22; 21.1) than πρῶτος and τέταρτος. It could have been possible in an early archetype that the adjective πρῶτος was abbreviated as A′ and then confused as Δ′at some point. But even those manuscripts that regularly abbreviate all or most numbers in the treatise do not abbreviate here. Jan's parallel and that at 20.11 do not clarify the situation. Jan's

parallel (19.3) cannot be applied exactly to this passage; though both passages describe the figures of the dia pente--one chromatic and enharmonic, the other diatonic--the chromatic and enharmonic constructions all proceed from the top: πρῶτος ὁ τόνος ἐπὶ τὸ ὀξύ (18.10f.); δεύτερος ὁ τόνος ἐπὶ τὸ ὀξύ (18.13); and τρίτος ὁ τόνος ἐπὶ τὸ ὀξύ. The enharmonic constructions vary: πρῶτον τὸ ἡμιτόνιον ἐπὶ τὸ βαρύ (19.1) πρῶτον ἐπὶ τὸ ὀξύ (19.2) δεύτερον ἐπὶ τὸ ὀξυ, πρῶτον ἐπὶ τὸ βαρύ. The parallels at 19.5-20.11 all prefer the ἐπὶ τὸ ὀξύ construction until the seventh and last example has ἐπι τὸ βαρύ.

18.20 The diatonic genus also has four εἴδη in the dia pente system. As with the dia tessaron system, these diatonic figures are again specified by the location of the lone hafltone, not by the pyknon or whole tone which Cleonides used for the enharmonic and chromatic genera. In the first diatonic figure the significant halftone is the lowest interval of the dia pente. Cleonides omits an example since an equivalent example can be found in the parallel first figure of the enharmonic and chromatic dia pente (from hypate meson to paramese). There might seem to be three possible locations for this first diatonic figure of the dia pente; one of them ranges from hypate meson to paramese, but the series with the halftones at their lowest interval--between hypate hypaton and parhypate hypaton, and between paramese and trite diezeugmenon ascend as ½ + 1 + 1 + ½, not correctly as ½ + 1 + 1 + 1.

The conjunct system will not apply here, for it lacks a dia pente which has a halftone at its bottom. All the possibilities add up to only three whole tones, not three and one-half.

MCQ omit all or most of the discussion of the diatonic figures; MC make other obvious errors at 18.9, 13, 18, 19; 19.3.

19.2 The second figure of the diatonic dia pente has its halftone at the top of the other three intervals, and again the only series of three whole tones plus one halftone is to be found in the same spot in which the second chromatic and enharmonic figure was found--parhypate meson to trite diezeugmenon. The formulation now is 1 + 1 + 1 + ½. The conjunct system has no series of three consecutive whole tones.

19.2-3 The third figure of the diatonic dia pente has its halftone second from the top. The formulation here is 1 + 1 + ½ + 1, and so there is not only one possible location for this series; no longer are three consecutive whole tones necessary, and so any series of 1 + 1 + ½ + 1 will fit the description: Parhypate hypaton to lichanos meson; lichanos meson to paranete diezeugmenon; trite diezeugmenon to paranete hyperbolaion. Even the conjunct system will provide two possibilites--parhypate meson to paranete synemmenon (which has the same pitch as diatonic trite diezeugmenon) and parhypate hypaton to lichanos meson. In this multiplicity of locations the third diatonic figure differs from the third enharmonic and chromatic figures. These are limited in that only two whole tones fall in the entire two-octave system, and the lowest whole tone (proslambanomenos to hypate hypaton) lies too low.

19.3 The fourth and last figure of the diatonic dia pente has its halftone as the third interval from the top. The formulation here (ascending) is 1 + ½ + 1 + 1. As with the diatonic third figure and with the chromatic and enharmonic fourth figure, the diatonic fourth figure also has more than one possible location; it has four--proslambanomenos to hypate meson, lichanos hypaton to mese, mese to nete die-

zeugmenon, and paranete diezeugmenon to nete hyperbolaion. If the conjunct tetrachord is added, there will be one more example--lichanos meson to nete synemmenon.

All the manuscripts offer τρίτον ἐπὶ τὸ βαρύ, while Jan prints πρῶτον. His defense is the parallel in 18.18, but he invented that πρώτος too. For more detail, see n. 18.18. In this particular line, Jan does not have the paleographical possibilities he had at 18.18 (τέταρτος→Δ→Α→πρῶτος). It is difficult to confuse τρίτον for πρῶτον, at least as difficult as confusing ὀξύ for βαρύ, if not more difficult. As in 18.18, none of the solutions by Jan, the manuscripts, or Meibom is totally satisfactory.

The four figures of the diatonic dia pente can now be diagrammed to show the expected circular pattern:

DISJUNCT SYSTEM					CONJUNCT SYSTEM				
fig. 1:	½	1	1	1	fig. 1:	--			
fig. 2:	1	1	1	½	fig. 2:	--			
fig. 3:	1	1	½	1	fig. 3:	1	1	½	1
fig. 4:	1	½	1	1	fig. 4:	1	½	1	1

19.4 Cleonides now moves on to the figures of the next largest consonance, the dia pason. He will not offer any figures for the dia pson and dia tessaron, or the dia pason and dia pente, nor, of course, for the double dia pason. There are seven figures in the dia pason, and they differ once again by formulation of the diatonic halftone and of the chromatic and enharmonic pyknon. Seven figures are to be expected since there are seven intervals (eight notes) to be rearranged in seven ways, just as three figures were made of the three intervals

in the dia tessaron system and four figures were made of the four intervals in the dia pente system.

The first of the seven chromatic and enharmonic figures of the dia pason is bounded by barypyknoi and has the whole tone in the highest postion. Since there are only two whole tones in the chromatic and enharmonic two-octave system--proslambanomenos to hypate hypaton and mese to paramese--and since the former is the bottom interval in the entire system, the latter tone will be the only one of concern until the seventh figure where the tone will be at the bottom of the figure. Similarly, since there is no whole tone other than that from proslambanomenos to hypate hypaton in the conjunct system, that, too, will be of no use to Cleonides until the seventh figure.

This first figure ranges from hypate hypaton to paramese and consists of the requisite six tones; it is formulated ½ + ½ + 1½ + ½ + ½ + 1½ + 1 in the chromatic and ¼ + ¼ + 2 + ¼ + ¼ + 2 + 1 in the enharmonic. It is called Mixolydian; cf. 25.6f. These names did not originally label the σχήματα of the dia pason; they originally labeled actual τόνοι (=ἁρμόνιαι) and were later transferred to the σχήματα. These figures of the dia pason bear no "Key" characteristics and were not really used musically, only musicologically. For an excellent though dogmatic discussion of this and most related matters (with bibliography), see Otto Gombosi, "Key, Mode, Species," JAMS 4 (1951) 20-26 and "Studien zur Tonartenlehre des frühen Mittelalters, I" Acta Musicologica 10 (1938) 149-74. Gombosi is incorrect in stating that our Greek sources "do not say that the species were to be found between the respective degrees of the systema teleion; they say only that their intervallic structure, the functional role of their tones, is the same as

that of the specific degrees of the systema teleion." (p. 23 "Key..."). Cleonides does not say this.

Jan mistakenly termed these figures modi, but some of the bibliography he cites (p. 197) is useful. See Anonymous Bellermann 9, Aristoxenus 46.17-47.16, Porphyry 82, 86, Michaelides "Tonos" 355-40, and J. F. Bellermann, Die Tonleitern und Musiknoten der Griechen (Berlin 1847) 7.

Phrasing very similar to ὑπὸ τῶν ἀρχαίων can be found in Aristides 12.5, 12; 43.28; et al.; cf. Bacchius #47 (=Cleonides).

19.8 Q (not L (Jan)) adds δὲ after δεύτερον. There is a μὲν after πρῶτον (19.4) in all the manuscripts, but none add δὲ after τρίτον, τέταρτον, πέμπτον, ἕκτον, or ἕβδομον in the following lines. The series of diatonic figures (20.14-21.3), however do have δὲ after each of the ordinals δεύτερον through ἕβδομον. Cleonides seems to be fairly consistent within a passage, but he is not necessarily consistent in two separate but related passages; cf. supra ᾗ (9.3f.), ᾗ (11.10f.), and ᾗ (15.4f.).

The second chromatic and enharmonic figure of the dia pason is bounded, as expected, by mesopyknoi and the whole tone is second from the top. The figure ranges from parhypate hypaton to trite diezeugmenon and is called the Lydian. The construction of the first and second figures of the dia pason so far follows exactly the construction of the first and second figures of the dia pente. The Lydian is then formulated as follows:

chromatic: ½ + 1½ + ½ + ½ + 1½ + 1 + ½

enharmonic: ¼ + 2 + ¼ + ¼ + 2 + ¼

19.11 The third chromatic and enharmonic figure of the dia pason ranges from (chromatic and enharmonic) lichanos hypaton to (chromatic and enharmonic) paranete diezeugmenon, and it is labeled the Phrygian. Cleonides still follows the pattern established for the dia pente figures, and so the dia pason figure is bounded by oxypyknoi and has its whole tone third from the top. The formulation of intervals here:

chromatic: $1\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + 1\frac{1}{2} + 1 + \frac{1}{2} + \frac{1}{2}$

enharmonic: $2 + \frac{1}{4} + \frac{1}{4} + 2 + 1 + \frac{1}{4} + \frac{1}{4}$

Notice how Cleonides omits the addition of χρωματική or ἐναρμόνιος here with λιχανός and παρανήτη.

19.14 The fourth chromatic and enharmonic figure of the dia pason stretches between barypyknoi again, this time between hypate meson and nete diezeugmenon. This Dorian figure resemble the Mixolydian in that they are both bounded by barypyknoi, but the whole tone in the Mixolydian was highest, while here it is fourth highest. The formulation:

chromatic: $\frac{1}{2} + \frac{1}{2} + 1\frac{1}{2} + 1 + \frac{1}{2} + \frac{1}{2} + 1\frac{1}{2}$

enharmonic: $\frac{1}{4} + \frac{1}{4} + 2 + 1 + \frac{1}{4} + \frac{1}{4} + 2$

20.3 The fifth chromatic and enharmonic figure of the dia pason continues predictably to be bounded by mesopyknoi and to have its whole tone fifth from the highest. It is known as the Hypolydian and ranges from parhyapte meson to trite hyperbolaion. The formulation:

chromatic: $\frac{1}{2} + 1\frac{1}{2} + 1 + \frac{1}{2} + \frac{1}{2} + 1\frac{1}{2} + \frac{1}{2}$

enharmonic: $\frac{1}{4} + 2 + 1 + \frac{1}{4} + \frac{1}{4} + 2 + \frac{1}{4}$

20.7 The sixth chromatic and enharmonic figure of the dia pason is bounded by oxypyknoi and ranges from (chromatic and enharmonic)

lichanos meson to (chromatic and enharmonic) paranete hyperbolaion. The Hypophrygian locates its whole tone now sixth from the top:

chromatic: 1½ + 1 + ½ + ½ + 1½ + ½ + ½

enharmonic: 2 + 1 + ¼ + ¼ + 2 + ¼ + ¼

20.8 C has ἡ for ἐπὶ, which is incorrect. Jan recorded M as also reading ἡ, but he was incorrect; M has ἐπὶ. The confusion between ἡ and ἐπὶ is easy to make since the abbreviation for ἐπὶ is formed ⏌.

20.10 The seventh and last chromatic and enharmonic figure of the dia pason ranges for a third time between barypyknoi, but this time the whole tone is the lowest note in the figure. This now means that there will be more than one location in the two-octave system since the octaves from proslambanomenos to mese and from mese to nete hyperbolaion are identical in internal interval structure. It also means that the conjunct system may now participate even though the octave in it will be exactly the same as the lower octave in the disjunct system. This figure is called several names, the "ordinary," "Hypodorian," and "Locrian." The formulation is as follows:

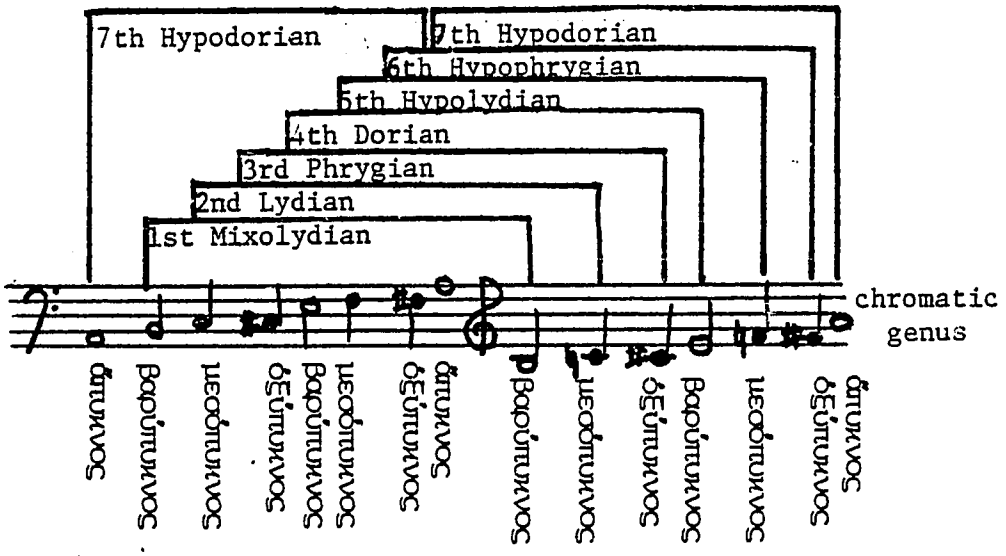
chromatic: 1 + ½ + ½ + 1½ + ½ + ½ + 1½

enharmonic: 1 + ¼ + ¼ + 2 + ¼ + ¼ + 2

20.13 The manuscripts disagree as to the alternate name of the Hypodorian figure of the dia pason. MC^1P^1 read λοκριὸν (though Jan incorrectly reported M's reading as λοκριστὶ), while C reads λοκριστὶ. λικριστικὸν--a combination of a corrected copy, i.e. λοκριστι κον --can be found in P. Bryennius 108.11 has λοκριστὶ (in a passage borrowed from Cleonides), and Bacchius #77 has the same. Gaudentius, however,

(347.10) has λοκριόν. Apparently both forms were acceptable and interchangeable.

The seven figures of the chromatic and enharmonic dia pason can now be diagrammed together. As with the dia tessaron and dia pente figures, these show a circular and ascending progression. Unlike the dia pente figures, however, there is no overlapping of the figures (because each dia pason figure has only one (or two) locations.



Formulations:

fig. 1: ½ ½ 1½ ½ ½ 1½ 1 Mixolydian
fig. 2: ½ 1½ ½ ½ 1½ 1 ½ Lydian
fig. 3: 1½ ½ ½ 1½ 1 ½ ½ Phrygian
fig. 4: ½ ½ 1½ 1 ½ ½ 1½ Dorian
fig. 5: ½ 1½ 1 ½ ½ 1½ ½ Hypolydian
fig. 6: 1½ 1 ½ ½ 1½ ½ ½ Hypophrygian
fig. 7: 1 ½ ½ 1½ ½ ½ 1½ Hypodorian

20.14 Cleonides now completes his lengthy discussion of the figures by adding the seven figures of the dia pason in the diatonic genus. He will once again describe the diatonic figures by locating the halftone but just one location will not be enough. In any consecutive intervals in the diatonic two-octave system there will be two halftones because each tetrachord is formulated by ½ + 1 + 1. Because of the inclusion of two halftones Cleonides now gives two halftone locations, always giving the lowest location first. All these diatonic figures in the dia pason will, like those of the dia tessaron and dia pente, be parallel to the chromatic and enharmonic figures in that the first figure will range from hypate hypaton to paramese, and each succeeding figure will rise from the next note above it, and the seventh and last figure will range from mese to nete hyperbolaion as well as from proslambanomenos to mese. The formulation of each figure will differ from that of the chromatic and enharmonic, of course, and so will the location of the individual movable notes which bound figures 2, 3, 5, and 6.

The first figure ranges from hypate hypaton to paramese, and its two halftones are located at the bottom and fourth from the top. No other location fits this description; if the halftone between hypate meson and parhypate meson were used at the bottom, there would be no halftone (mese-paramese) fourth from the top. If the halftone paramese--trite diezeugmenon were used, the halftone nete diezeugmenon to trite hyperbolaion will fall on the third interval above that, but there will only be seven notes between paramese and nete hyperbolaion. If the conjunct system is used, the absence of the whole tone between mese and paramese will cause the seven intervals above the halftones hypate hypaton--parhypate hypaton and hypate meson--parhypate meson to

equal only five and one-half and five intervals (and only seven notes), respectively.

The disjunct system alone will therefore fit the first figure and only between hypate hypaton and paramese. This diatonic Mixolydian figure will be formulated: ½ + 1 + 1 + ½ + 1 + 1 + 1.

M^1 writes ἐν δὲ τῷ διατόνῳ,but the parallel phrases for the dia pente and dia tessaron figures, 18.20 and 17.17, offer no τῷ, nor does Cleonides' use of ἐν μὲν ἁρμονίᾳ καὶ χρώματι (17.15 . Apparently, Cleonides' Greek did not call for the use of the article in such phrases. C^1 reads τοῦ for τὸ (cett.), and once again the internal parallels--τοῦ δὲ διὰ πασῶν εἴδη ἐστὶν ἑπτὰ 19.4 , τοῦ μὲν οὖν διὰ τεσσάρων τρία ἐστὶν εἴδη 1 7.8-9), and τοῦ δὲ διὰ πέντε τέσσαρά ἐστι σχήματα 18.9 --verify that τοῦ should be read here. The phrase τοῦ διὰ πασῶν simply modifies εἶδος.

20.15 The reading in MCP--πρῶτόν τε καὶ τέταρτον ἐπὶ τὸ ἡμιτόνιον--is interesting, but it will not work. The halftone cannot be at the highest point, for the figure would not then parallel the first figure of the chromatic and enharmonic, if, in fact, that is what the reading means; ὀξύ ἐστι τὸ has been omitted.

20.16 The second diatonic figure of the dia pason has its two halftones third from the bottom and first at the top. This figure will range from parhypate hypaton to trite diezeugmenon and is called Lydian. If the highest halftone were that between nete diezeugmenon and trite hyperbolaion, the other halftone would be fourth from the bottom, not third, since the intervening whole tone mese--paramese changes the construction. The conjunct system omits the whole tone, and so it will

add up to five and one-half tones. The formulation of this second diatonic figure of the dia pason is: 1 + 1 + ½ + 1 + 1 + 1 + ½

ἕβδομον (Ψ) for πρῶτον, making the two halftones third and first from the bottom (= seventh from the top), forms a construction that could never exist in the diatonic genus; all the halftones are at least four intervals apart (½ + 1 + 1 + ½), and this reading would require them to be three intervals apart.

20.17 The third diatonic figure of the dia pason has its two halftones both located second from each end, that is, second from the top and second from the bottom. This figure, called the Phrygian, will range from diatonic lichanos hypaton to diatonic paranete diezeugmenon. The formulation here is 1 + ½ + 1 + 1 + 1 + ½ + 1.

Cleonides changes his phraseology here, a rarity here in the σχήματα-passage. One might have preferred to see τρίτον δὲ οὗ δεύτερον μὲν ἐπὶ τὸ ὀξύ, δεύτερον δὲ ἐπὶ τὸ βαρύ, but none of the manuscripts offer alternatives.

20.18 The fourth diatonic figure of the dia pason has its two halftones at the lowest position and third from the top. It ranges from hypate meson to nete diezeugmenon and is called Dorian. Formulation: ½ + 1 + 1 + 1 + ½ + 1 + 1.

In none of the first six figures will the conjunct system or any other part of the disjunct system be involved, The mandatory whole tone between paramese and mese will otherwise be absent. The whole tone is essential because two diatonic tetrachords (½ + 1 + 1 + ½ + 1 + 1) equal five tones; six are necessary to form a dia pason, and therefore an extra whole tone must be added. But elsewhere in the dis-

junct system or in the conjunct system there are only halftones on either side of two diatonic tetrachords.

For τρίτον Z′ reads πρῶτον and CP read τέταρτον. Z's reading is musicologically impossible; two halftones in a diatonic system cannot have six intervals between them. τέταρτον is musicologically possible, but this forms the first figure (first at the bottom, fourth from the top).

20.19 The fifth diatonic figure of the dia pason positions its halftones fourth from the bottom and first at the top. This, the Hypolydian, ranges from parhypate meson to trite hyperbolaion. The formulation is 1 + 1 + 1 + ½ + 1 + 1 + ½.

M omits μεν...δε and reverses the positions of the numerical adjectives; this produces the first figure again. U substitutes δεύτερον for πρῶτον δὲ, but the halftones in a diatonic dia pason cannot be second from the top and fourth from the bottom (xx½x½x), for the halftones must have at least two intervals between them. Q substitutes ἕβδομον for the πρῶτον, but ἕβδομον ἐπὶ τὸ ὀξύ is the equivalent of πρῶτον ἐπὶ τὸ βαρύ, and this produces still again the first figure. A number of manuscript variants seem to be attempting to change figures back into the first figure.

20.20 The sixth diatonic figure of the dia pason locates its halftones third from the bottom interval and second from the top. This, the Hypophrygian figure, ranges from diatonic lichanos meson to diatonic paranete hyperbolaion. The formulation is 1 + 1 + ½ + 1 + 1 + ½ + 1.

V paraphrases with ἕκτον δεύτερον δὲ, πέμπτον ἐπὶ τὸ ὀξύ,

which is a gloss intrusion--1 + 1 + ½ + 1 + 1 + ½ + 1--a correct one, in fact, rare as that is in this passage. The other variants here are musicological nonsense.

20.22 The seventh and last diatonic figure of the dia pason resembles the seventh chromatic and enharmonic figures in that it has the same two locations--proslambanomenos to mese, and mese to nete hyperbolaion. It will fit also into the conjunct system since the whole tone is now at the bottom of the figure and the disruptive conjunct halftone, mese--trite synemmenon, is above and beyond the figure. This figure in the conjunct system will include exactly the same notes as that in the disjunct system. The halftones are now positioned second from the bottom and third from the top, and the formulation is this: 1 + ½ + 1 + 1 + ½ + 1 + 1.

MCP confuse βαρὺ and ὀξὺ in 20.22 and 21.1, argument for suspecting the manuscripts' βαρὺ in 18.18. They would have the halftone second from the top and third from the bottom--1 + 1 + ½ + 1 + 1 + ½ + 1--which forms the sixth figure. Z would have the halftone first at the top and second from the bottom--1 + ½ + 1 + 1 + 1 + 1 + ½--which is an impossible formation. U has the halftones second from the bottom and fifth from the top; more nonsense. Generally speaking, the great number of manuscript variants for these figures is alarming. From our knowledge of the dia tessaron and dia pente figures in Cleonides, and from the parallels in Bacchius (#11, 14) we know that the figures as described in this text are the correct ones. Occasionally Q has substituted a correct gloss for the first location, but for the most part these variants are musicologically absurd. One wonders what the scribes were trying to accomplish; or did they simply confuse $\overline{\alpha}$, $\overline{\beta}$, $\overline{\gamma}$, etc.?

21.1 Cleonides parallels 18.6-8, his closing sentence of the dia tessaron figure discussion. The diatonic figures have the same top and bottom notes as the chromatic and enharmonic figures, and they have the same names. This statement is slightly incorrect, though, since the parhypate, lichanos, trite, and paranete are quite different notes in the three genera. Cleonides is not being so detailed here. All he means to say is, if the chromatic second figure of the dia pason ranges from parhypate hypaton to trite diezeugmenon, then the enharmonic will range from parhypate hypaton to trite diezeugmenon and the diatonic will range from parhypate hypaton to trite diezeugmenon. He realizes that parhypate hypaton and trite diezeugmenon are not the same pitch in the three genera, but he simplifies the matter here for the sake of apparent uniformity.

All seven figures for the diatonic may be diagrammed this way by halftone locations:

fig. 1: 1st lowest--4th highest (Mixolydian)

fig. 2: 3rd lowest--1st highest (Lydian)

fig. 3: 2nd lowest--2nd highest (Phrygian)

fig. 4: 1st lowest--3rd highest (Dorian)

fig. 5: 4th lowest--1st highest (Hypolydian)

fig. 6: 3rd lowest--2nd highest (Hypophrygian)

fig. 7: 2nd lowest--3rd highest (Hypodorian, Locrian)

The intervallic formulation of the diatonic figures again shows the circular progression. The (1 + 1 + 1) represents the three consecutive whole tones from parhypate meson to lichanos meson, lichanos meson to mese, and mese to paramese. When these whole tones lie in the first position in the Hypolydian, they no longer are calculated into

the distance between halftone intervals, so the Hypolydian, Hypophrygian, Hypodorian, and Mixolydian, have only four intervening whole tones, not five:

Mixolydian	½ + 1 + 1 + ½ + (1 + 1 + 1)
Lydian	1 + 1 + ½ + (1 + 1 + 1) + ½
Phrygian	1 + ½ + (1 + 1 + 1) + ½ + 1
Dorian	½ + (1 + 1 + 1) + ½ + 1 + 1
Hypolydian	(1 + 1 + 1) + ½ + 1 + 1 + ½
Hypophrygian	1 + 1) + ½ + 1 + 1 + ½ + (1
Hypodorian	1) + ½ + 1 + 1 + ½ + (1 + 1

21.4 After the long discourse on the figures of the dia tessaron, dia pente, and dia pason systems, Cleonides now returns without fanfare to the remaining four differences in systems.

All the systems described by Cleonides--the dia tessaron, dia pente, dia pason, dia pason and dia tessaron, dia pason and dia pente, and double dia pason--are rational. Though irrational intervals and irrational systems do exist, they have no application for the regularized constructions and systems which Cleonides describes. Only his system composed of soft chromatic tetrachords would form an irrational system.

Z has δύοις εἰς for διοίσει, and the error is repeated at 21.8 and again at 21.12.

21.5 The scribe of Q here wished to have the same parallelism which Jan sought by his reversing of the word order here, but Q and Jan change the order of different phrases.

21.8 Cleonides briefly describes the fifth difference in systems.

Some systems are consecutive, others non-consecutive. As Cleonides' rational and irrational systems differed in consisting of rational and irrational intervals, consecutive systems are made of consecutive notes and non-consecutive systems are made of non-consecutive notes. Cleonides refers only to consecutive systems elsewhere in the treatise.

ἐξῆς is an adverb frequently put to technical use by mathematicians (Euc. 8.1; Archim. Spir. Praef. 11) and grammarians (A.D. Pron. 41.3). The latter use it in opposition to ὑπερβατόν as do the musicologists. Plato (Prt. 343 E) and Aristotle (Rh. Al. $1435^{a}37$), however, use the word to describe "transposed" words or "inverted" phrases. Musicologists other than Cleonides use the term frequently, e.gg. Bacchius #26, 65, 81, 84; Aristides 1.22, 10.21, 23.14.

21.10 Meibom has δι' ὑπερβατῶν for κατὰ ὑπερβατόν, citing Bryennius I.6 (=109.24). But only Venetus Marcianus gr. 321 (Jonker's Mb) has the variant ὑπερβατῶν (with no mention of δι' for κατὰ).

21.11 The sixth difference in systems--conjunct vs. disjunct--is one which Cleonides has touched on before in his discussion of systems differing by consonance and dissonance (15.14--16.20): After describing the six major consonances he then listed the four consonances in the συνημμένον σύστημα (16.16f.). Once again it seems as if Cleonides did not assume total ignorance on the part of his reader.

Cleonides spends more effort on this particular difference in systems than he had on the last two. He divides the passage into three sections: 1) After distinguishing conjunct and disjunct systems (21.11-14) he then defines the conjunction (συναφή) and the disjunction (διάζευξις) (21.14-17), names and locates the three conjunctions

(21.17-22.7), and locates the single disjunction (22.7-9); 2) then he names the two perfect (τέλεια) systems (22.10-11), describing the lesser perfect system (22.11-16)and the greater perfect system (22.17-23.7); and then he describes the ametabolic system--the combination of the two perfect systems (23.8-13). Each of these points is discussed at the appropriate location in the commentary. At this point in the treatise Cleonides finally explains the five tetrachords hypaton, meson, synemmenon, diezeugmenon, and hyperbolaion, and the two perfect systems; even so, the reader needed to know these constructions earlier. Once the reader officially understands these structures here he can return to the earlier two-thirds of the treatise with greater understanding, and yet the earlier two-thirds of the treatise are preliminary to this passage and also comprehensible in their own terms.

The difference between a conjunct (συνημμένον) and disjunct (διεζευγμένων) system derives from its tetrachordal composition. The conjunct system contains conjunct tetrachords only; the disjunct system contains disjunct tetrachords as well. Cleonides is careful to point out that both diezeugmenon and synemmenon tetrachords must be consecutive (ἑξῆς), that is, the hypaton and diezeugmenon tetrachord are not connected, but this does not certify them as "disjunct." By definition disjunct tetrachords are tetrachords which belong next to each other, have a similar figure, and have a whole tone (διάζευξις) between them. "A similar figure" (ὁμοίων κατὰ σχῆμα) must refer to their genus. A diatonic tetrachord can in no way be conjunct or disjunct with a chromatic or enharmonic tetrachord. Both tetrachords must have the same genus (and figure).

For συνημμένων, see <u>supra</u>, n. 16.16. διεζευγμένον means

"separated, parted." The word is not common in Greek literature, but it is found in grammatical terminology (A.D. Synt. 185) as well as in mathematics (Nic. Ar. 2.21--διεζευγμένη μεσότης, "discrete mean").

21.12 MCP add διέσεων before συνημμένων, but the diesis has no relationship at all to conjunct tetrachords in their general construction. Dieses do appear in enharmonic conjunct tetrachords, but they have no importance in this particular description of conjunctions. Perhaps the origin of the word's presence in the manuscripts was a mistaken correction above δια τῶν in an archetype.

21.14 Having differentiated conjunct and disjunct systems, Cleonides now defines συναφή as the common note between two consecutive (and therefore conjunct) tetrachords. The common note, φθόγγος κοινός, is already familiar to Cleonides' reader; the συνημμένον σύστημα mentioned at 16.16f. by necessity has two φθόγγοι κοινοί, and the disjunct system also has two. In the conjunct system the common notes are hypate meson and mese; hypate meson is common to the hypaton and meson tetrachord, and mese is common to the meson and synemmenon tetrachords. In the disjunct system, which contains two conjunctins, the common notes are hypate meson--common to the hypate and meson tetrachord--and the nete diezeugmenon--common to the diezeugmenon and hyperbolaion tetrachords.

The whole tone between the tetrachords falls between mese and paramese. This, by definition, is the disjunction--διάζευξις. The whole tone belongs to no tetrachord; it divides the meson and diezeugmenon tetrachords, whence the name διεζευγμένον.

21.17 Cleonides now names the three conjunctions--βαρυτάτη ("low"), μέση ("middle"), and ὀξυτάτη ("high"). He then locates them (21.17-22.7). Each falls on one of the φθόγγοι κοινοί just mentioned. The ὀξυτάτη occurs only in the disjunct system, the μέση conjunction in only the conjunct system, and the βαρυτάτη in both systems.

Q inverts to read πᾶσαι αἱ συναφαί. By putting πᾶσαιin the predicative position, Q misunderstands the syntax; cf. Smyth 1174a-b. C has the plural μέσων for μέσον, but there is only one whole tone between disjunct tetrachords.

21.18 Only Q has the βαρυτάτη before μέση. One would generally expect Cleonides to put the three location-words in ascending order. When he discusses these three locations in the next few sentences (22.1-7), he has them in the ascending order. On the other hand, perhaps he has arranged them in the manuscript order--μέση, ὀξυτάτη, βαρυτάτη--because he was thinking of the two larger systems, for in the conjunct system there are two conjunctions βαρυτάτη and μέση, and in the disjunct βαρυτάτη and ὀξυτάτη. βαρυτάτη could rightfully appear last in the list since it alone exists in both systems, and Cleonides generally lists the conjunct system before the disjunct, e.gg. 21.14 and 21.16. The best reason for reading μέση, ὀξυτάτη, βαρυτάτη, is that the manuscripts demand it. Q in this passage has perhaps been typically a little too creative (cf. 21.13, 21.7, 20.21), and the scribe of its archetype may have made the same correction we would hope for. On the other hand, it would not have been at all difficult for a scribe early on in the tradition to have misplaced βαρυτάτη, and then a corrector could have misplaced the superlinear βαρυτάτη when reinserting

it into the line. Although paleographical conservatism demands the manuscripts' order, internal evidence and paleographical possibility as well as common sense all demand βαρυτάτη, μέση, ὀξυτάτη.

22.1 Jan brackets ἑκ incorrectly. It is true that a conjunction (συναφή) does not range from (ἑκ) one tetrachord to another; otherwise the construction would be ἡ ἑκ ὑπάτων ἐπὶ μέσων. But a conjunction involves two tetrachords, which is what ἡ ἑκ τοῦ ὑπάτων καὶ μέσων τετραχόρδου means, "The conjunction is from the hypaton and meson tetrachords." All the manuscripts read ἡ ἑκ, and Jan has no reason to ignore the tradition. The construction τοῦ plus tetrachord name (genitive plural) τετραχόρδου has its parallel in Aristides 8.13-14: τοῦ τῶν μέσων τετραχόρδου.

22.2 Both αὐτὰ ($M^1C^1P^1$) and αὐτῇ (MCP) can be construed here. συνάπτω can take an accusative object plus a dative (indirect object) when transitive as well as a dative when intransitive. With αὐτῇ the sentence means, "The lowest conjunction is that from the hypaton and meson tetrachord; the note common to it, hypate meson, joins [them]." But this construction is more awkward than that with αὐτὰ, "The lowest conjunction is that from the hypaton and meson tetrachords; the common note, hypate meson, joins them." The plural seems to be necessary since it refers to the two tetrachords being in common; it is not really the conjunction which is "in common" with the note. The same applies to the readings in 22.4 and 22.6.

22.3 MCP(L) have νητῶν συνημμένων which elsewhere in Cleonides would describe notes, not a tetrachord. The note νήτη συνημμένων cannot include a conjunction; it is the tetrachord συνημμένων which has the con-

junction. But νητῶν συνημμένων can also be an alternate name for the synemmenon tetrachord. It can be found at Gaudentius 333.22, 23, 25, 27. Gaudentius 345.3-4) also uses νητῶν to name the diezeugmenon and hyperbolaion tetrachords as many manuscripts (all but C) say Cleonides does at 22.8. Elsewhere in this passage Cleonides is satisfied to name the tetrachords simply συνημμένων, διεζευγμένων, and ὑπερβολαίων(22.5, 6, 7, 12-13, 14; 23.1, 3-4); the manuscripts do add νητῶν three times at 23.12 (bis) 23.13. It is extremely difficult to determine whether these νητῶν are original with Cleonides. It is not impossible that Cleonides uses a different source for this passage and that this source used the νητῶν terminology. On the other hand, a later scribe might have added the νητῶν to clarify Cleonides' tetrachords; perhaps the scribe had recently read Gaudentius. What is troublesome is the inconsistency; between 21.11 and 23.8 νητῶν is found in the manuscripts five times and omitted seven times. There is no functional difference between the two names; it is true that νητῶν is found only when the tetrachord is named qua tetrachord, that is, not as the name of a note. It is also true, therefore, that when the tetrachord is used to name an individual note, νητῶν is always omitted. Yet there are phrases in which tetrachord are used qua tetrachords but do not have as accompanying νητῶν, e.gg. 22.5, 6). Another posssibility is seen in the subdivisions of the passage under discussion. In the passage on συναφή and διάζευξις (21.11-22.9) νητῶν can be found. It can also be found in the passage on the ametabolic system (23.8-13). In the middle passage on the perfect systems, however, νητῶν is not to be found. Conceivably, Cleonides uses two different sources here, one using νητῶν, one not. But νητῶν is still missing occasionally in the first passage on συναφή

and διάζευξις.

The best solution for the problem is to leave νητῶν in the text where it has strong support from good manuscripts. This solution does not result, as it must seem, so much from a conservative paleographical approach as it does from a respect for the whims of Greek musicological terminology. Gaudentius does not always adhere to the νητῶν terminology even with one passage or within one sentence; cf. 345.1-4. Apparently the two different terminologies were interchangeable, much as were σχήματα (17.4, 7, 16) and εἴδη (18.4, 19.4) earlier.

22.5 τοῦ (U om.) certainly belongs before διεζευγμένων; it has parallels in τοῦ ὑπάτων(22.1) and τοῦ μέσων (22.3). The second τοῦ (before ὑπερβολαίων) read by V (and Jan) is unnecessary. Parallels for its omission can be found at 22.1, 4, and 8.

22.7 There is only the one disjunction (διάζευξις), the tone between mese and paramese, dividing the meson and diezeugmenon tetrachords.

22.8 The singular feminine αὐτὴν has excellent manuscript support, but it is hard to imagine to what this αὐτὴν could refer. διάζευξις is the only visible feminine singular, but does "a tone disjoin a disjunction"? αὐτὰ, neuter plural, refers to the two tetrachords meson and diezeugmenon, and a tone certainly joins them (by disjunction). The parallel αὐτὰ at 22.2, 4, and 6 suffer themselves from manuscript variations (αὐτῇ).

22.10 For other discussion of the perfect systems, see Aristides 14.15, Aristoxenus 179-80, Porphyry 258, Ptolemy 2.1, Gaudentius #6-7,

Nicomachus #11, Bryennius 110.14-112.11, Bacchius #74, 80, and the bibliography in Michaelides "Systema" 319-20.

Cleonides has not yet left the discussion of how systems differ by conjunction and disjunction. He has already explained what conjunctions and disjunctions are (21.12-17), and he has described them. He has also located them in a larger system (22.2-9) by naming notes--hypate meson, mese, paramese, nete diezeugmenon, etc. Now Cleonides takes the conjunctions and disjunction and for the first time formally arranges them as the conjunct (lesser) and disjunct (greater) "perfect" systems. There is nothing presented here that Cleonides' reader will not already know; in order to understand the σχήματα and conjunct and disjunct systems, he had to understand at least the appearance of the perfect systems. The two systems are described below at 22.11 and 22.17.

The term τέλεια had two musical connections in ancient Greece. One was a type of aulos, for which see Aristoxenus (ap. Ath. 14.643 E-F) who recognizes "perfect" auloi and "superperfect" (ὑπερτέλειοι) auloi; cf. FHG 286, fr. 67, and Michaelides "Aulos" 42-46 with bibliography. The information on auloi is from Aristoxenus' last work, "On Piercing Auloi" (Περὶ αὐλῶν τρήσεως).

The second use for τέλειος was in describing a system, the usage which Cleonides employs here. Generally, the adjective was widely used in inscriptions (as an epithet) and in medicine. In arithmetic the term referred to "perfect" numbers (Theon 45), those numbers which are equal to the sum of their divisors, e.g. 6 = 3 + 2 + 1; cf. n. 6.11. While the word usually is found to be translated as "perfect," the "perfect" system is not immaculate; it is "filled out, completed."

22.11 The lesser perfect system (ἔλαττον τέλειον σύστημα) is simply the same conjunct system (συνημμένον σύστημα) already mentioned and limted by Cleonides at 16.16-17. It ranges from proslambanomenos to nete synemmenon and includes three tetrachords--hypaton, meson, and synemmenon. All three tetrachords are conjunct, and this means that there are two conjunctions in all--hypate meson and mese. Then there is one more whole tone at the bottom of the system, the proslambanomenos. The whole systems spans the fourth consonance, dia pason plus dia tessaron (eight and one-half tones). The system has different appearances, of course, in each of the genera, although the fixed notes proslambanomenos, hypate hypaton, hypate meson, mese, and nete synemmenon remain the same in each genus. The formulations are these:

diatonic: 1 + ½ + 1 + 1 + ½ + 1 + 1 + ½ + 1 + 1

chromatic: 1 + ½ + ½ + 1½ + ½ + ½ + 1½ + ½ + ½ + 1½

enharmonic: 1 + ¼ + ¼ + 2 + ¼ + ¼ + 2 + ¼ + ¼ + 2

22.14 ὑπὸ τῶν (C) for ὑπάτων is a fine example of how incorrect word division can lead to a facilior lectio.

22.15 The dative συμφώνῳ (U) is the best reading; it agrees with τῷ διὰ πασῶν καὶ διὰ τεσσάρων. The accusative and genitives will not construe. One could argue for σύμφωνον...τὸ (M), ὁρίζεται being in the middle voice with an active meaning, but M, which reads τὸ σύμφωνον here reads συμφώνων...τὸ in the parallel in 23.6. In all fairness, however, U reads συμφώνωνhere but does not also read τῷ (C). The parallel at 23.6-7 preserves two alternatives συμφώνων...τὸ (MC) or συμφώνῳ...τῷ (M^1C^1), the latter being the more desirable. Obviously, the manuscript tradition is quite corrupt here, but the sense and grammar are clear.

22.17 The greater perfect system (μεῖζον τέλει σύστημα) contains the disjunction between mese and paramese. It ranges fromproslambanomenos to nete hyperbolaion and have four tetrachords within it--two groups of two conjunct tetrachords, one group being disjunct from the other. The two groups of two conjunct tetrachords are the hypaton and meson, and then the diezeugmenon and hyperbolaion. The disjunction lies, of course, between the meson and diezeugmenon tetrachords. Besides this whole tone disjunction, there is another whole tone, as with the lesser system, between proslambanomenos and hypate hypaton. The entire range of the greater perfect system is covered by the sixth consonance, the double dia pason (twelve whole tones). Again, the system will have a different appearance in each of the genera, although the fixed notes proslambanomenos, hypate hypaton, hypate meson, mese, paramese, nete diezeugmenon, and nete hyperbolaion will remain the same. The formulation of intervals is as follows:

diatonic: 1 + ½ + 1 + 1 + ½ + 1 + 1 + 1 + ½ + 1 + 1 + ½ + 1 + 1

chromatic: 1 + ½ + ½ + 1½ + ½ + ½ + 1½ + 1 + ½ + ½ + 1½ + ½ + ½ + 1½

enharmonic: 1 + ¼ + ¼ + 2 + ¼ + ¼ + 2 + 1 + ¼ + ¼ + 2 + ¼ + ¼ + 2

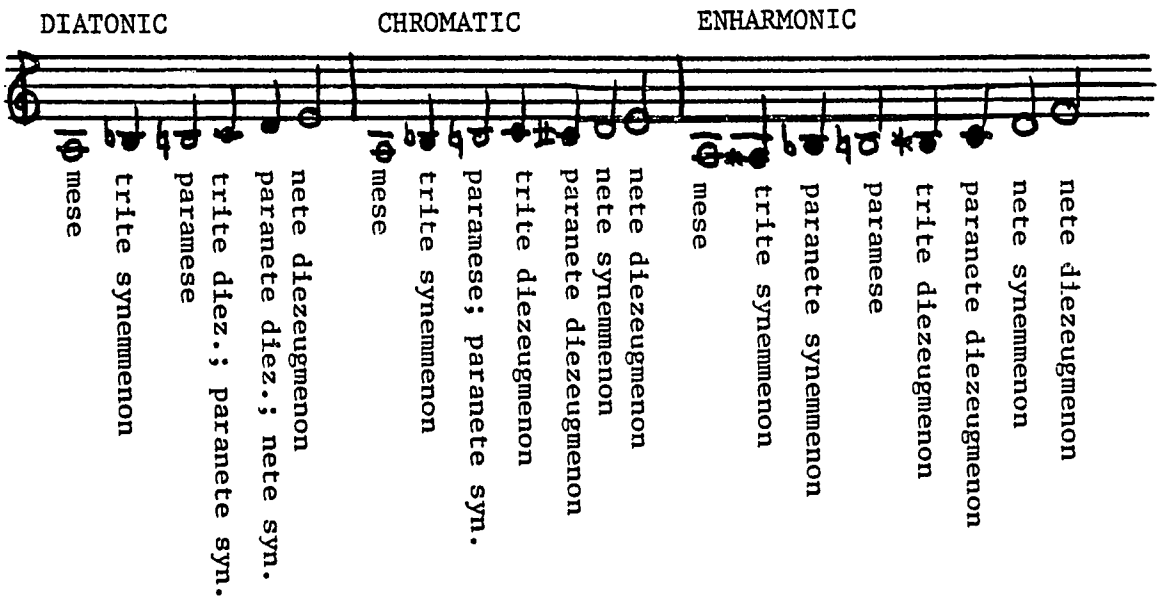
23.6 For συμφώνων and τὸ, see <u>supra</u>, n. 22.15.

ὁρίζεται (M^1P^1) should be read, not διορίζεται (MCP); an exact parallel can be found in 22.15-16. Neither word is a technical term found frequently in Greek musicology, though ὁρίζεται would have entered Cleonides' vocabulary via peripatetic influence.

It is curious that Cleonides here describes the second whole tone as ἀπὸ παραμέσης εἰς μέσην. Elsewhere in the treatise he usually describes intervals in as ascending manner. Q's emendation is unnec-

essary, for an interval is a space and actually has no direction.

23.8 Cleonides concludes his discussion of conjunct and disjunct systems with the ametabolic system. He had already introduced it (4.5-7.15, 16.2, 23.8, and 23.14), but he formally does so here, even if he never tells the reader he is doing so. The ametabolic system simply combines the two perfect systems. Above mese comes the synemmenon tetrachord as well as the paramese and the diezeugmenon and hyperbolaion tetrachords. Two tetrachords, the lower two--hypaton and meson--are common to both conjunct and disjunct systems. When Cleonides listed the names of the notes in each genus (4.5-7.15) he gave all the notes in the ametabolic system. He, like Alypius (passim) and Gaudentius (#23), lists the synemmenon t etrachord in its entirety after mese. Cleonides and the others do so despite the fact that some of the notes in the diezeugmenon tetrachord are lower in pitch than some of the notes in the synemmenon tetrachord:



πέντε δὲ ὄντων τετραχόρδων is the first of three genitive absolutes in the treatise; the others are at 23.20-21 and 24.1. M[1]

reads ἐμμεταβόλῳ for ἀμεταβόλῳ, but Cleonides would be confusing matters to name the modulating system here. Both the modulating and non-modulating systems have the same notes, however, all the notes, that is, in both perfect systems; cf. supra, 23.14f.

23.9 Cleonides' use of σύνθετον here is not the technical term "composite." It means simply "composed." The technical term σύνθετον is found again shortly after this (23.21).

23.10 ἑκατέρῳ (C^L); ἑκατέρων (cett.): κοινός normally takes a dative although the genitive and a preposition are possible. If the genitive was used by Cleonides here, it would be correct for him to have the article before τελείων [συστημάτων], since ἑκάτερος plus noun has an intervening article; the article is also correct if Cleonides wrote ἑκατέρῳ τῶν τελείων. When Cleonides uses κοινός elsewhere, only once does he have a dependent adjective parallel to ἑκάτερος. At 10.10 he has κοινός plus genitive; cf. 23.11 ἴδια τοῦ and Bacchius #81. Unfortunately, Cleonides has already proven that his phraseology in one passage may not necessarily resemble that in another (possibly similar) passage. I print ἑκατέρων but reserve my doubts in respect for the manuscript tradition other than C^1.

23.14 Cleonides has reached the seventh and last difference in systems, a project which he first announced at 15.8-9. It should be pointed out that Cleonides could not mention this difference until he had discussed the previous six, especially conjunct and disjunct systems.

He omits διαφορᾷ in this last distinction between systems as he had at 15.14; he used the word at 21.4 and 21.8.

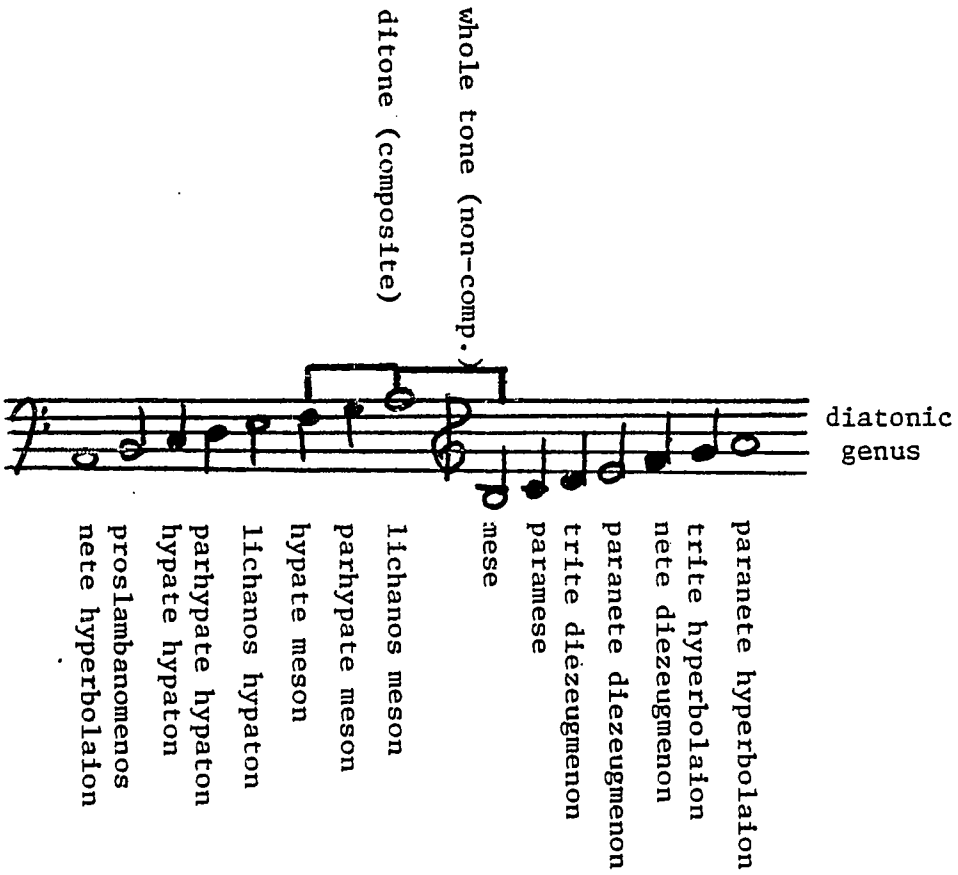
For parallels for the ἀμετάβολον and ἐμμετάβολον systems, see

Plutarch De defectu oraculorum 437 D; Aristides 14.24f.; Bacchius #29, 80; Ptolemy 32.1-27; Nicomachus #4; Euclid Sectio Canonis #19. The word ἀμετάβολος is not found outside of musicology, nor is ἐμμετάβολος. Both words are compounds of μεταβολή, a word which Cleonides will discuss in limited detail at 26.19. ἐμμετάβολος is found only at Aristides 16.24 (he uses μεταβαλλόμενα at 14.25) and Bryennius 104.6 and 112.4 (both passages copied from Cleonides).

23.16 Parallels for ἁπλᾶ and μη ἁπλᾶ can be found at Aristides 13.9-11, Aristoxenus 23.4f., 50.16-25, Bryennius 112.4-11, and Michaelides "Haploun" 126.

By definition simple systems (ἁπλᾶ σύστημα) are systems which have only one mese. Such a system is unvariable (ἀμετάβολον). When Cleonides referred to all the notes (4.5-7.15) and when he described the conjunct and disjunct systems and their combination (21.11-22.13), he was referring to the ametabolic system. In describing the σχήματα of the dia pente and dia pason consonances (17.4-21.3) Cleonides already showed how interval relationships within a system could be changed. The mese in each of these figures can move. In the diatonic figures of the dia pason, for instance, in the first figure mese is located as the second note from the top; on the second figure it is the third note from the top, and so on until the seventh figure it is either the bottom or top note of the figure. As the bottom of a system a note should not be called "mese," because it is obviously not the note in the middle. "Mese" needs another definition, therefore, and Cleonides offers it here in 23.18-24.2. Only the simple (ἀμετάβολον) system has the single mese, where the note actually does sit in the niddle of the two-octave system. The changeable systems, however, as if they were

massive quasi-σχήματα of the whole perfect system, move this mese:



Mese here is no longer the "middle" notes, for the whole system has been moved upwards. Mese labeled here is not functional mese, but a mese by position. The note which used to be called (in the ametabolic system) "paramese," is now called "mese," and the note which used to be called "mese" is now called "lichanos meson." This new lichanos meson functions like a mese "by definition," for in disjunction it has a non-composite whole tone above it and a ditone (composite of two whole tones in the diatonic) below it. This is the functional definition of mese (φθόγγου δύναμις, or μέση κατὰ δύναμιν). When Cleonides says that the non-simple systems have two, three, or a multitude of mesai, he refers to the moving names of the notes. In one sense, the functional, there

is only one mese; it is the only note which has both a non-composite whole tone above it and a composite (halftone plus trihemitone in the chromatic, whole tone plus whole tone in the diatonic) or non-composite (ditone in the enharmonic) ditone below it. In another sense, the nominal (or κατὰ θέσιν), the metabolic system has fifteen mesai in each genus, for every note in the two-octave system can be called mese. But only one of these fifteen can actually function as mese at one time. When the note labeled "mese" also functions as mese, that "mese" is the mese in the ametabolic system. Incidentally, by Cleonides' terminology here, the above system would be labeled as πολλαπλάσιον (23.18).

A discussion of the ametabolic and metabolic systems which focuses on μέση κατὰ δύναμιν and μέση κατὰ θέσιν is found in Ptolemy 2.5. See also Arist. Metaph. 1018^{b}; Pol. 1245^{a}; and [Arist.] 20 1919^{a}).

23.20-22 The τόνον ἀσύνθετον is (functionally) the non-composite whole tone between mese and paramese. The ἔχει is MC cannot be correct; the sentence already has a finite verb in συμβέβηκε, and ἔχειν, the infinitive, depends on it. Cf. συμβαίνει...εἶναι (24.1-2).

U has ἁπαθοῦς ὄντος, but Jan printed his own ἁπαθῆ ὄντα. Jan wanted ἁπαθῆ ὄντα to modify τόνον, suggesting that the whole tone was unaffected by the system (though a dative τῷ συστήματι might have been used). It is true that the whole tone remains the same, but so does the system. The functions (κατὰ δύναμιν) of the notes in the changing (and un-changing) system never change, only the names and relative locations do (κατὰ θέσιν). The system remains essentially the same. There is still a central note--no matter by what name it is

called--above which is a non-composite whole tone and below which is a composite or non-composite ditone. The system is unaffected by the movement of notes, and this fact is explained in Cleonides' genitive absolute ἀπαθοῦς ὄντος τοῦ συστήματος.

Ignoring the manuscripts which omit the rest of the sentence (MCC^{1}P^{1}), one needs to establish the correct wording after ἐπὶ δὲ τὸ βαρὺ δίτονον and before ἀσύνθετον. U adds ἤτοι σύνθετον ἤ; S ἢ τὸν σύν. ἤ; and Z ἤτοι σύνθετον. Jan once again becomes paleographically fanciful and conjectures (musicologically) ἢ τριημιτόνιον ἢ τόνον ἀσύνθετον. Musicologically, the ditone beneath the functional mese is composite in the diatonic genus (whole tone plus whole tone), composite in the chromatic genus (half tone plus trihemitone), and non-composite in the enharmonic genus (ditone). But Jan has become another scholiast who explicates rather than edits the text. Z and S offer only inferior versions of the readings in U; they omit ἤ and mistake ἤτοι for ἢ τὸν. U then avers that the ditone beneath mese is "either composite or non-composite," and this is exactly what should be written here. There is no need for emendation at all. Jan tried to make the text too specific. Cleonides' definition covers all three genera, for it is a general definition and description of mese.

23.22 The mese in the conjunct system has to be located differently. The only whole tone in the conjunct system in the chromatic and enharmonic genera is between proslambanomenos and hypate hypaton. Since there is no whole tone with which to locate mese, Cleonides locates the note by its position in either the middle or highest tetrachords. (Interestingly, "mese" is not at all the middle of the ametabolic conjunct

system; the conjunct system probably postdates the disjunct.)

24.1 μετὰ χόρδων (U) is another good example of a facilior lectio.

24.2 ὀξυτάτῳ is a secure reading, having its parallel in βαρυτάτῳ in the same sentence; both modify an understood φθόγγῳ; cf. ᾧ (23.22, and φθόγγου 23.19).

24.3 αἱ (om. MCP) is desirable before δυνάμεις in order to signal the sentence's subject and for clarity of meaning. Cleonides normally uses the article before the subject of a sentence, e.gg. 2.13, 16, 20-3.1, 15, 18; 10.3; but cf. n. 3.7.

Since the mese is so easy to located in any variation of the perfect systems, one can then figure out the functions of the remaining notes by gaging their relationship to mese. If mese is moved one note downwards then the note above it must be paramese, the note below it lichanos meson, and then all the other notes are easy to label by relating them to these notes (κατὰ θέσιν).

24.4 MC have δύναμις, but with a plural verb; Z conjectures δυνάμει.

24.6 τόνος is the fifth major topic Cleonides examines. Neapolitanus gr. 260 (f. 55-64) even adds the title Περὶ τόνου before the passage. In some aspects of music, τόνος is a smaller entity than interval, genus, or system, and it is in this sense misplaced here as a "larger" subject. But in one sense of the word a τόνος is larger than and encompasses notes, intervals, and systems as well; this type of large τόνος is a huge, quasi-figure of the greater perfect system, and

so it is the "largest" musicological entity discussed up to this point.

Cleonides divides the passage (24.6-26.18) into four main sections since there are four different musical meanings and uses for the word τόνος. The first use of τόνος Cleonides discusses is that which serves as a synonym for "note" (φθόγγος) or "string" (χορδή)

The second use for the word (25.2-3) is an interval--the whole tone which has already been discussed (at 9.8; 9.18). The third type of τόνος (25.4-26.15) is that which serves as a τόπος φωνῆς; this is the relatively lengthy passage in which Cleonides discusses the pitch variations for the greater perfect system. This is also the type of τόνος which Cleonides defined supra at 2.4-5. The fourth and last type of τόνος (26.16-18) is that which serves as a synonym for "tuning" (τάσις). Cleonides discusses each definition of τόνος in order.

τόνος (from τείνω) originally referred to something stretched, i.e. a rope or chord. The word took on many specific meanings, e.g. "twisted skins" in siege engines (Plut. Marc. 15, "sinews" of animals (Hp. Art. 11). Musically the word referred to a number of things, as Cleonides is careful to point out. Plato (Rep. 617 B) uses τόνος as "pitch," and Xenophon (Cyn. 6.20) includes "volume" within this context. Plutarch (Mar. 827 B) writes of the "tone" of a musical instrument, and APL 4.220 (Antip.) has τόνος as a "diatonic scale."

For discussions of τόνος in other Greek musicologists, see Aristides 1.10, Porphyry 82.7, Bryennius 1.8 (who uses Cleonides as one of his sources), Bacchius #46-48 (where τρόποι is used for τόνοι), Gaudentius #20, Alypius #3 and passim (again with τρόποι), [Ptolemy] #7, Aristoxenus 46.17-47.17, Anonymous Bellermann 42, [Plutarch] 1134A-

1135 A, Martianus Capella #960-63; for secondary discussions, see the bibliographies in Gombosi (see supra, n. 19.4), Michaelides "Tonos" 335-40, and R. P. Winnington-Ingram, Mode in Ancient Greek Music Cambridge 1936 and Amsterdam 1962).

24.7 Z, an inferior manuscript, has ὡς before διάστημα. Since ὡς precedes each of the other three types of τόνοι in this sentence (ὡς φθόγγος, ὡς τόπος φωνῆς, ὡς τάσις), the ὡς before διάστημα has strong internal support. It also has parallel support at 25.4 (ὡς τόπος φωνῆς) and 26.16 (ὡς τάσις). On the other hand, τόνος as a διάστημα is not introduced with ὡς at 25.2. Z's ὡς is an intelligent conjecture, but an unnecessary one.

24.8 The first type of τόνος is equivalent to φθόγγος or even χορδή. By quoting lines written by Ion and Terpander Cleonides might suggest that this usage of τόνος was archaic. Perhaps to avoid this misunderstanding Cleonides added (25.1) that many others (καὶ ἕτεροι οὐκ ὀλίγοι) also use τόνος in this sense.

The phrasing of ἐπὶ...τοῦ φθόγγου is curious. While it is perfectly acceptable Greek, has a parallel (25.1-2: ἐπὶ δὲ τοῦ διαστήματος), and has no manuscript variants, Cleonides elsewhere words such phrases as τῷ μὲν τοῦ φθόγγου ὀνόματι (23.14) or ὡς φθόγγος (cf. 24.6-7) or φθόγγῳ (cf. 15.9, 12) or perhaps κατὰ φθόγγον (9.10, 12). On the other hand, as logically and orderly as Cleonides writes, he does not hesitate to vary his prepositional expressions between (and occasionally within) passages. Accordingly, Cleonides again uses the same construction at 25.2 ἐπὶ...τοῦ διαστήματος, but changes still again at 25.4 (ὁ δὲ ὡς τόπος φωνῆς) and 26.16 (ὁ δὲ ὡς τάσις).

24.9 φόρμιγξ: See H. Huchzermeyer, Aulos und Kithara in der griechischen Musik (Phd., Münster 1931); and C. Sachs, The History of Musical Instruments (New York 1940) 130.

The fragment here is evidence for the existence of a seven-stringed phorminx in the time of Terpander. Whether it was "new" (νέους) or simply "different" is hard to distinguish from this brief Lesbian fragment.

24.11 All the manuscripts agree with ἠμεῖς τοι, but Theodor Bergk, ed., Anthologia Lyrica^2 (Leipzig 1868), E. Hiller, and Otto Crusius, eds., Anthologia Lyrica (Leipzig 1907), and others insist on Σοὶ δ' ἠμεῖς. The meaning is the same, though the latter version is more emphatic. Nonetheless, the present text should preserve Cleonides' original text, not Terpander's; ἠμεῖς τοι should be read here. (The scansion remains the same in either reading.)

τετράγηρυς, "four-toned, four-voiced," is a hapax.

Most of the manuscripts quote these poetic lines between quotation marks and in an indented, colometric format. N refers the reader to the quotation as found in Strabo 13.

24.12 κελαδήσωμεν read by M would change the verse from future statement to an aorist exhortation, but the scansion (hexameter) will not permit the lengthened syllable.

24.14 These four poetic lines have received more editorial attention than any other passage in the treatise. Bergk^2, Bergk^3 (Leipzig 1883), Hiller-Crusius (see supra, n. 24.11), Théodore Reinach, "Un Fragment d'Ion de Chios," Revue des Études Grecques 14 (1901) 8-19,

U. von Wilamowitz, "Lesefrüchte," Hermes 37 (1902) 305-306, Friedrich Marx, "Critica et hermeneutica," Rheinisches Museum 83 (1934) 376-79, Hermann Diels, "Ein orphischer Demterhymnus," in Festschrift für Theodor Gomperz (Vienna 1902) 11, Pena, Menge, and Meibom all make emendations to the text.

The meter of the poem is elegiac, and this meter prohibits several readings: ἐνδεκαχόρδῳ (Bergk^3), ἑνδεκαχόρδῳ (Bergk^2 and cett.) have a long quantity (natural or by position) in their ultima, and this syllable must be short; the codices' ἔχοις ἀεὶ and ἔχεις ἀεὶ are hypermetric, though they could be subject to synezesis; the codices' τριώδους also fails to fit the meter; the λύρα τὴν in MCP is hypermetric, the την in U is hypometric; L's cretic τεσσ/ων is incorrect; and the οὖν for σ' in U is again hypermetric. Meibom made a metrically necessary emendation--ἔχουσα for ἔχοις (ἔχεις) ἀεὶ, and he followed S (that is, Vat. Reg. 169) in reading τριόδους for τριώδους. But the sense is still not satisfactory, and Wilamowitz addressed himself to this problem: He accepts the apostrophe in ἐνδεκάχορδε λύρα, allows Meibom's ἔχουσα τὰς to serve as an appositional clause, but he prefers the manuscripts' Aeolian ἔχοισα (from εχοισαειτας, though most of Ion's fragments are in Ionian dialect). He finds the article τὰς to be unnecessary in epic diction, and so he omits it as the hypermetric syllable. He then reads εἰς for εἰ to help construe the second accusative phrase (συμφωνούσας ἁρμονίας τριόδους). He translates, "Elfsaitige Leier, die du für die symphonischen Dreiwege der Harmonie eine zehnstufige Ordnung hast." He explains δεκαβάμονα as the equivalent of three tetrachords, but this would depend on whether conjunct or disjunct tetrachords were invovled; (½ 1 1 ½ 1 1 ½ 1 1--three conjunct

tetrachords will not work; ½ 1 1 1 ½ 1 1 1 ½ 1 1--three disjunct will work), and there is no evidence that tetrachords like this existed in Ion's age; cf. Plato's "scales" in Aristides 1.9 and Winnington-Ingram Mode in Ancient Greek Music (supra, n. 24.6) 22-30; see also J. Chailley, "Le Myth de modes grecs," Acta Musicologica 28 (1956) 137-63. Lastly, Wilamowitz read the codices' δια in the third line of the poem and translates as "Früher haben dich alle Hellenen als siebensaitige gespielt, wobei sie nur die ärmliche Harmonie διὰ τέσσαρα erhielten." διὰ τέσσαρα is unsatisfactory.

Charles Ruelle, "Quelques mots sur la musique des Grecs ancien et modernes," Annuaire de l'Association pour l'encouragement des études grecques en France 17 (1883) 296, n. 6, took exception to Meibom's treatment of the necessarily emended τριόδους as an adjective (meaning "triple"); he pointed out that the word must be a noun meaning "the crossroads" or "junction ot three roads." He translates as "concours consonant de l'harmonie," taking ἁρμονίας as a genitive. Reinach and Weil in their edition of Plutarch (123) thought four octaves were being discussed, and so they emended τριόδους to τέτρας. Later, Reinach ("Un Fragment") changed his mind and emended the text to τῶν συμφωνιουσῶν ἁρμονιῶν τριόδους.

The editor of Cleonides' text must opt inevitably to establish Cleonides' text rather than Ion's. This is no simple process and the result to be printed here may well be Ion's verse, but Cleonides himself may have had an incorrect exemplar of the poem. One hardly even knows whether to restore the proper meter. I follow M ἐν δεκάχορδε (with Bergk^{2} ἐνδεκάχορδε). omit MCP's τὴν as a gloss intrusion, and follow Wilamowitz' ἔχουσα εἰς as a restoration of the manuscripts'

hypermetric ἔχοις ἀεὶ τὰς, S's metrically correct τριόδους, and Pena's δὶς for the codices' διὰ.

δεκαβάμονα is a hapax meaning "with ten steps (or intervals). ἐνδεκάχορδος is another hapax; the first syllable must be ἐν (from ἔνδεκα). See Ptolemy 2.4 for the eleven-chord, and Michaelides "Hendekachordon" 133. It was Timotheus (of Miletus) that added the eleventh string (Nicomachus 274). Bryennius mentions the seven, eight, and ten-stringed lyre at 116.19, 56.3. See also Aristides 85.8, 91.5, 92.12, [Aristotle] 19.10, Nicomachus 243.12, 266.1, and [Ptolemy] #23.

24.15 Here ἁρμονίας probably refers to the early form of musical scale; cf. supra, n. 1.3.

25.1 ἕτεροι include Euripides Alc. 446 and perhaps the Bacchylides scolion in POxy. 1361 Fr. 1.2.

The second definition of τόνος is that which uses it as a synonym for διάστημα. Actually, τόνος refers to only one particular type of interval. Cleonides already introduced the τόνος interval at 3.13 when he formulated the diatonic genus, and again at 9.8 when discussing the size of intervals. He listed τόνος as a dissonant interval at 9.18, as a composite interval in the chromatic genus and non-composite in the diatonic genus (10.13-14), and as an irrational interval at 11.5. The τόνος here described at 25.1-2 has all of the above properties and associations. The example of a τόνος that Cleonides gives, from mese to paramese, is well-chosen; it is the central τόνος above mese in the greater perfect system. He might, of course, have added the whole tone from proslambanomenos to hypate hypaton, but Cleonides characteristically limits his number of examples to one.

Other non-composite τόνοι can be found throughout the diatonic genus, and composite τόνοι can be found in the chromatic genus from hypate hypaton to lichanos hypaton, etc. None are to be found in the enharmonic genus except the omnipresent whole tones between proslambanomenos and hypate hypaton and between mese and paramese. Cleonides is typically Aristoxenian here; a Pythagorean would define a τόνος as the difference between a dia pente and dia tessaron, e.g. Ptolemy 11.1-2.

25.4 The third and most elaborate definition of τόνος refers to location of voice or sound (τόπος φωνῆς--25.4-26.15). This humble phrase, τόπος φωνῆς, seems to conceal behind itself the most massive and encompassing collection of quasi-figures in all of Greek musicology. τόνοι in this particular sense are quasi-figures of the greater perfect system in that they move up and down the system. Where the τόνοι differ from σχήματα is in interval arrangement; figures differ in internal interval arrangement, while τόνοι differ in relative pitch. Figures also differ in pitch when diagrammed on the greater perfect system, but their internal interval relationships change at each pitch difference; for the τόνοι the internal interval arrangement remains essentially the same. Only the pitches and names of the notes change.

The problems involved in discussing τόνοι--also called τρόποι by Bacchius and Alypius--are most recently examined by Gombosi and Winnington-Ingram; the problems concern the relationship of the τόνοι and the figures of the dia pason. They ask which fostered which, which was actually practical and which was merely theoretical, and what pitch relationships, if any, either the octave figures or the τόνοι had. Fortunately, Cleonides does not present the opportunity for this con-

troversy to take root in this treatise. In discussing his dia pason figures, Cleonides was quite clear in moving the various figures up the (relative) scale in pitch, all the while changing the internal interval relationships. It is true that Cleonides does not discuss these figures as if they were melodic structures or as if their relative pitch had any significance (Gombosi). On the other hand, Cleonides does not in any way suggest, as Gombosi dogmatically asserts ("Key" 23), that the figures of the dia pason were all to be formed within the same octave. They were to move up the scale from hypate hypaton-parамese to mese-nete hyperbolaion. The pitch is not significant, however, which is what Winnington-Ingram avers. The figures of the dia pason are formed up and down the (greater perfect system) scale, yet once one reaches the seventh dia pason figure (mese-nete hyperbolaion) he has also reached the same figure at proslambanomenos-mese. Ultimately I have to agree with Gombosi that the purpose of the figures (in Cleonides) was purely schematic, musicological, and pedagogical. But in some authors the names of the τόνοι are not used at all in describing the figures of the dia pason, e.g. Boethius 4.15-16, who follows Ptolemy. See Calvin Bower, Boethius' Principles of Music; an Introduction, Translation, and Commentary (Phd, Nashville 1966) 447; and Richard L. Crocker, "Aristoxenus and Greek Mathematics," Aspects of Medieval and Renaissance Music: A Birthday Offering to Gustave Reese, ed. Jan La Rue (New York 1966) 96-110, esp. 106-108); as well as Winnington-Ingram Mode 48-55, 66.

Cleonides divides his discussion on τόνος as τόπος φωνῆς into three subdivisions, the first giving three general examples of this type of τόνος (25.4-25.5); the second listing the thirteen τόνοι

found in Aristoxenus (25.6-26.8); and the last explaining the order and arrangement of these thirteen τόνοι (26.9-15).

Cleonides chooses the "simply" named, i.e. non-compound, central τόνοι--Dorian, Phrygian, Lydian--as his examples.

Jan's rearrangement, τόπος φωνῆς ὅταν λέγωμεν is advantageous in that it preserves the word order τόπος φωνῆς used in the introductory sentence at 24.7. A parallel for the manuscript's division of τόπος φωνῆς might be found at συμφώνῳ...τῷ (22.15-16), but that division is not nearly as awkward as the division of the dependent genitive φωνῆς from its nominative τόπος by a new clause (ὅταν λέγωμεν).

The Dorian, Phrygian, and Lydian τόνοι mentioned here are in the opposite order to those listed supra at 20.2, 19.3, and 19.10.

25.6 It is quite probable that Cleonides never wrote τόνοι at the end of this sentence (MCP). The word (cett.) is no doubt a gloss.

For the sake of uniformity with 14.20f., I print here δεκατρεῖς. The form δεκατρεῖς (for τρεῖς καὶ δεκά) is found at D. 47.77.

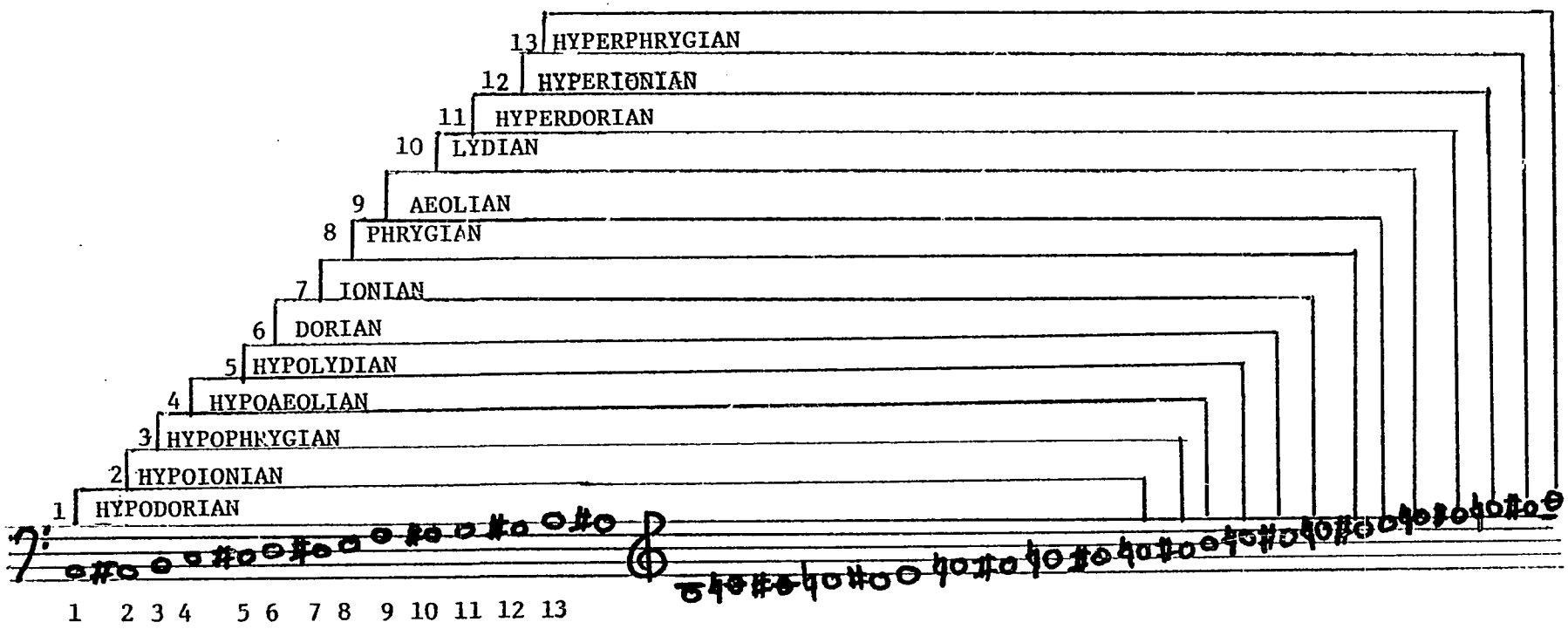
Aristoxenus is mentioned by Cleonides just this once. This would not be odd except that his name appears twice in Martianus Capella (#212, 924), twice in Aristides (20.5, 10), and some twelve times in Ptolemy. On Aristoxenus, see da Rios 93-136 (testimonia); Rudolph Westphal, Aristoxenus von Tarent II (Leipzig 1883; reprint Hildesheim 1965) i-xii; J. F. Mountford, "Aristoxenus" OCD^2 118-19; and Jan, "Aristoxenus" RE II 1057-1065.

25.7f. The Hypermixolydian is the highest of the thirteen tones. Cleonides' treatise does not make the slightest hint of any awareness of a permanent pitch upon which to base the greater perfect system,

and so Cleonides does not specify on what pitch the Hypermixolydian (and thus all the other tones) commence. Alypius, Boethius, Gaudentius, Bacchius, Anonymous Bellermann, and Aristides recognize the quasi-alphabetical vocal or instrumental musical notation used in the extant musical fragments; but Cleonides ignores notation completely. In addition, Cleonides never tells us if these tones are to extend one or two octaves.

Alypius lists, or intends to list, fifteen τόνοι in each of the three genera. His diatonic and chromatic lists, complete with instrumental and vocal notation, are all extant; he enharmonic lists are extant only in part. His lists clearly extend two complete octaves, not one. Also, his lists show that the τόνοι are more than figures. Figures have the same number of intervals, the same number of notes, but a different arrangement of intervals. Alypius (and Cleonides?) τρόποι have the same number of intervals, the same number of notes and the same arrangement of intervals. τόνοι differ from each other in pitch, that is, in the relative locus of each τόνος. According to Alypius' lists, the Hypodorian alone resembles the "white-key" diagrams shown in this commentary; Cleonides, too, commenced his lowest τόνος (Hypodorian) at proslambanomenos.

The τόνοι each extend two octaves; the entire gamut covered by the thirteen Cleonidean τόνοι will then encompass three octaves (A--a--á--a̋); this overextends the two and one-half dia pason limit imposed by Aristoxenus:


13 HYPERPHRYGIAN
12 HYPERIONIAN
11 HYPERDORIAN
10 LYDIAN
9 AEOLIAN
8 PHRYGIAN
7 IONIAN
6 DORIAN
5 HYPOLYDIAN
4 HYPOAEOLIAN
3 HYPOPHRYGIAN
2 HYPOIONIAN
1 HYPODORIAN
1 2 3 4 5 6 7 8 9 10 11 12 13

There is a problem inherent in trying to locate Cleonides' τόνοι via Alypius' τρόποι; we do not know precisely to what pitch each of Alypius' notational symbols refer. There is a missing link between ancient Greek notation and modern notation, and so scholars have only guessed at the proper pitches referred to. Barbour, Bellermmann, Gombosi, Reinach, Macran, Westphal, Sachs, and Jan all assume the Hypolydian to be the τόνος which requires no sharps or flats in the modern Western notation, but Auda, Greif, and Vincent assign this property to the Hypodorian, and Düring, Riemann, and Abert assign it to the Dorian τόνος. For a brief discussion of these matters, see J. M. Barbour, "The Principles of Greek Notation," JAMS 13 (1960) 16-17.

Above the Hyperphrygian is where the other post-Aristoxenians add the fourteenth and fifteenth τόνος--the Hyperaeolian and Hyperlydian, e.gg. Alypius 374, 389, 404, and 371, 386, 401; and Gaudentius 353-54.

$C^{1}P^{1}$ have ὁ καὶ. The article could be construed with the participle, but Cleonides does not bother to write complete sentences or clauses in describing any of the thirteen τόνοι. He merely lists them and only then describes each with a relative clause or participle (except for δώριος and ὑποδώριος).

25.8 Aristides and Bryennius both use the Mixolydian for the Hyperionian and Hyperdorian. For the Mixolydian, see Arist. Pol. $1340^{b}1$; Pl. Rep. 398 E; Ptol. 62.24, 63.7, et al.

25.11 M(U) omit ὧν ὁ βαρύτερος altogether. With ὧν ὁ βαρύτερος omitted, the verb καλεῖται would have to be καλούμενος or else a severe

lack of connective would result. Moreover, without ὧν ὁ βαρύτερος the sentence does not distinguish whether it is the lower or higher Lydian τόνος which is called the "Aeolian." Lastly, a similar construction is used in 25.8-10, and another as well at 26.6. (Other parallels have their own manuscript variants.)

26.1 M omits entirely the Phrygian (and Ionian) τόνοι, which was obviously a serious oversight. C omits ὧν ὁ βαρύτερος--καὶ (26.4). Only P has the text correctly. The phrase found in M^1 is based on Aristides 20.13 and sounds like a gloss: φρύγιοι δύο, ὁ μὲν, βαρὺς ὃς καὶ ἰάστιος, ὁ δὲ ὀξυς. Perhaps the scribe of M^1 saw that M had omitted the qualifications of the Phrygian τόνος, so the scribe turned to Aristides or his source for help.

26.4 For the manuscript variants, see <u>supra</u>, n. 25.11.

26.5 C^2 has made errors of transposition in writing καλεῖται· ἰάστιος καλεῖται ὧν ὁ βαρύτερος.

For ὑποαιόλιος, see Martianus Capella #935; Bryennius 116.24, 164.3, 304.9; Aristides 20.12; Gaudentius #23; and Alypius 373, 388, and 403.

26.7-8 U adds καὶ before ὑποδώριος, but Cleonides is listing the τόνοι; no particles appear at the beginnings of any of the phrases, and the parallel at 26.3 (δώριος εἷς) has no καὶ added before or after.

26.9 This is one of the few points in the treatise where all the manuscripts are obviously wrong. The manuscripts read τούτων ὀξύτατος μὲν δώριος (M) or, τούτων ὀξύτατος μὲν ὁ δώριος (P^1C^1). In 26.14 Cle-

onides states clearly that the Hypodorian is the lowest τόνος, the Hypermixolydian the highest (ὁ δὲ ὑπερμιξολύδιος τοῦ ὑποδωρίου τῷ διὰ πασῶν ἐστιν ὀξύτερος);

Jan prints τούτων ὀξύτατος μὲν ὁ ⟨ὑπερμιξολύδιος, βαρύτερος δὲ ὁ ὑπο⟩δώριος--Menge with angel brackets, Jan in small print--an emendation for which he neither takes nor gives credit. The emendation makes good musicological sense, but it has no paleographical support. Jan no doubt thought that he had to complete the μὲν-clause and then answer it with a δὲ-clause. But the δὲ appears in the next sentence (οἱ δὲ ἐξῆς...) and is not necessary, although not impossible, in the first sentence.

Rather than make such a large addendum to the text, I prefer to assume a much simpler omission--simply ὑπο, and a polar error--ὀξύτατος for βαρύτατος. To omit ὑπο- from ὑποδώριος would have been a simple mistake for a scribe to have made. δώριος is a facilior lectio, and a ligature for ὑπο- could have been easy to omit or confuse. The polar error, the confusion of ὀξύτατος for βαρύτατος is not unparalleled in the manuscript tradition of this very treatise (21.1 βαρὺ for ὀξύ; 20.22 ὀξὺ for βαρύ).

26.10-11 ὑπερέχοντες takes the genitive ἀλλήλων and a dative of degree of difference ἡμιτονίῳ; cf. Archyt. 2. MCP have ἡμιτόνιον, which creates an awkward syntax.

All the manuscripts except Q have τῶν ὀξυτάτων. Q's τοῦ ὀξυτάτου makes better sense. Cleonides does not refer to the "highest τόνοι," but to the highest τόνος. He says that the difference between any two consecutive τόνοι is one halftone, and this is true "from the

highest τόνος" (τοῦ ὀξυτάτου (=ὑπερμιξολύδιος)) "to the lowest τόνος" (τοῦ βαρυτάτου). In addition, MCP seem to have had difficulty with their archetype here; cf. 26.9 and 26.11 (bis). For a diagram of these halftone intervals between τόνοι, see supra, p. 340.

If the lowest τόνος, Hypodorian, has it proslambanomenos on our modern A, then the Hypoionian has its proslambanomenos on A♯ the Hypophrygian on B, and so on:

Hyperphrygian	A
Hyperionian	G♯
Hyperdorian	G
Lydian	F♯
Aeolian	F
Phrygian	E
Ionian	D♯
Dorian	D
Hypolydian	C♯
Hypoaeolian	C
Hypophrygian	B
Hypoionian	A♯
Hypodorian	A

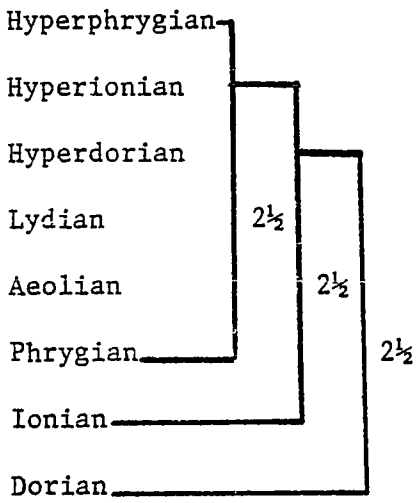
26.12 Jan adds τόνον, οἱ δὲ τρίτοι between δύο and τριημιτόνιον. MC have τριημιτόνιον, and M^1P have τριημιτονίῳ. Q in frustration omits the entire sentence from παράλληλοι to τριημιτονίῳ. Strunk translates without Jan's addition, "[the distance] between two parallel tones [τόνοι] is a trihemitone." This will not work musicologically. If two consecutive τόνοι stand a halftone apart, then τόνοι which stand

a trihemitone apart should be παράλληλοι. But the quasi-technical term παράλληλος in Greek musicology refers only to disjunct tetrachords; see Aristides 14.2. The τόνοι which stand a trihemitone apart--the Hypodorian, Hypoaeolian, Ionian, Lydian, and Hyperphrygian--have nothing of importance in common, nor do the other τόνοι which proceed a trihemitone apart. Jan's addition does give some sense to the sentence: Each consecutive τόνος stands one halftone apart; each second consecutive τόνος stands one whole tone apart, and each third consecutive τόνος stands a trihemitone apart. But while Jan's addition makes musicological sense, it also makes the sentence superfluous. If each two stand a halftone apart, then each third τόνος will of course stand a trihemitone apart; nothing is learned here. If one distorts Aristides' use of παράλληλοι--two tetrachords joined by disjunction, i.e. with a τόνος between them--he might try to assert that "two parallel τόνοι stand a trihemitone apart." But this is not true; by definition the two parallel τόνοι would have to stand a τόνος apart. As is stands in the manuscripts and in Jan's emendation, the sentence is not satisfactory.

To preserve the manuscripts' reading as closely as possible, and to render the sentence musicologically sound and paleographically useful, I suggest an emendation for τριημιτονίῳ (M^1P). If parallel τόνοι must stand a halftone apart, then perhaps ἡμιτονίῳ was the original reading, (or, if MCP have ἡμιτόνιον correctly at 26.11, ἡμιτόνιον). Conceivably τριημιτονίῳ could have been part of a(n) (incorrect) gloss; perhaps simply the word ἡμιτονίῳ was confused with τριημιτονίῳ.

There is still another possibility. Suppose Cleonides originally wrote παράλληλοι δὲ δύο καὶ ἡμιτονίῳ with the καὶ for τρι-.

This wording could refer to two [whole tones] and a halftone, that is, to five halftones. The distance between the τόνοι which have parallel names, e.gg. Hypodorian, Dorian, Hyperdorian, is five halftones:



On the other hand, καί could be abbreviated as ϵ or kj , and these abbreviations would not seem to be conducive to be confused with τρι- or its ligature. Moreover, δύο καὶ ἡμιτονίῳ is not the best way to express "two and one-half whole tones" or "five halftones"; δύο [τόνοι (τόνοις)] καὶ ἡμιτονίῳ would be better, as would πέντε ἡμιτονίοις.

παράλληλος is apparently not a technical term in musicology. It can be found only at Aristides 14.2, 98.17, 100.7; Bryennius 110.6, 180.16; Ptolemy 18.5, 48.51, 91.1. Cleonides uses the word a second times (29.4).

26.14 M seems to have ὑπομιξολύδιος, a frequent type of error; cf. 25.9 (ὑπεριάστιος).

26.16 The fourth and last type of τόνος is equivalent to τάσις, "tuning." It is clear that one can raise or lower "the tuning" or keep it in the middle range. But Cleonides does not take the trouble to explain precisely what is "tuned" here--an instrument, a melody, or a

voice. He does use the word φωνῆς at 26.17, and this word is probably the object of ὀξυτονεῖν and βαρυτονεῖν, τινα being the subject. In this case, τόνος could be translated almost as "tessitura" or "range."

βαρυτονεῖν is used by Dionysius of Halicarnassus (2.58) meaning "to pronounce with the grave accent." LSJ translate Cleonides' verb as "to use the grave accent," but this is clearly impossible. ὀξυτονεῖν can mean "to pronounce with an acute accent," but Nicomachus (#10) gives it a specifically musical connection--τοὺς φθόγγους ὀξυτονεῖν "to make high-pitched notes"; this is clearly the sense used by Cleonides.

26.19 μεταβολή is the sixth subject Cleonides promised to discuss at 1.6f. It follows the discussions of genus, system, and τόνος since modulations occur between various genera, systems, and τόνοι. Cleonides'progressive learning method does occasionally (cf. 16.2f.) suffer from interruptions and transpositions; he discusses here a fourth type of μεταβολή--κατὰ μελοποιίαν--but he will not discuss μελοποιία until 28.19-29.15.

Cleonides divides this passage on modulation (26.19-28.18) into five sections. After the customary introductory sentence (26.19-27.2), Cleonides then describes how modulation occurs between genera (27.2-27.4), between systems (25.5-27.6), and between τόνοι (27.6-27.10). After the latter section Cleonides appends a discussion of emmelic and ekmelic modulations (27.10-28.2). Having finished the technical aspects of modulation, Cleonides then concludes the passage on modulation with a relatively lengthy section on modulation by μελοποιία or "melodic composition" (28.3-28.18). Here Cleonides approaches

most closely a discussion of ἦθος.

For parallel passages, see Aristides 1.11, Bacchius #50-57, 88, Anonymous Bellermann 30-32, Bryennius 1.9 (cited by N here), [Plutarch] 1133 B-C, Ptolemy 2.6, Aristoxenus 47.17-48.10, Martianus Capella #964-66. See also W. Vetter, "Metabole" RE XV 1313-16.

Cleonides begins his discussion on μεταβολή (μεταβολὴ δὲ λέγεται τετραχῶς) with the same phraseology he employed in introducing τόνοι(24.6: τόνοι δὲ λέγεται τετραχῶς). He used the verb λέγειν in the first instance because the musical term τόνος has different connotations in different authors; "τόνοι are described in four ways." It is not only that there are different types of τόνοι as there are different forms of genera or different notes, but there are entirely different meanings of the word even within the musicological world. In the μεταβολή passage, however, λέγεται is used to mean almost "there are." Musical μεταβολή has only one connotation, and there are four different types of modulation. Though these four types of μεταβολή may have different effects and mechanics, they all fall under the same definition of μεταβολή.

27.2 The first type of modulation is by genus, but Cleonides never really explains how one is to produce a modulation by genus. The treatise is not (unfortunately) and does not purport to be a manual for those who would reproduce Greek music; it merely divides and describes the musicological parts and events which can theoretically occur in Greek music. Therefore Cleonides "explanation" of modulation by genus offers nothing more than the statement that one genus can modulate into the other two. As expected, Cleonides begins his discussion of the

first type (of four) with μὲν οὖν; he used the same particle in other sentences which introduce a list of διαφοραί, e.gg. 1.9, 7.17, 8.3, and 15.9.

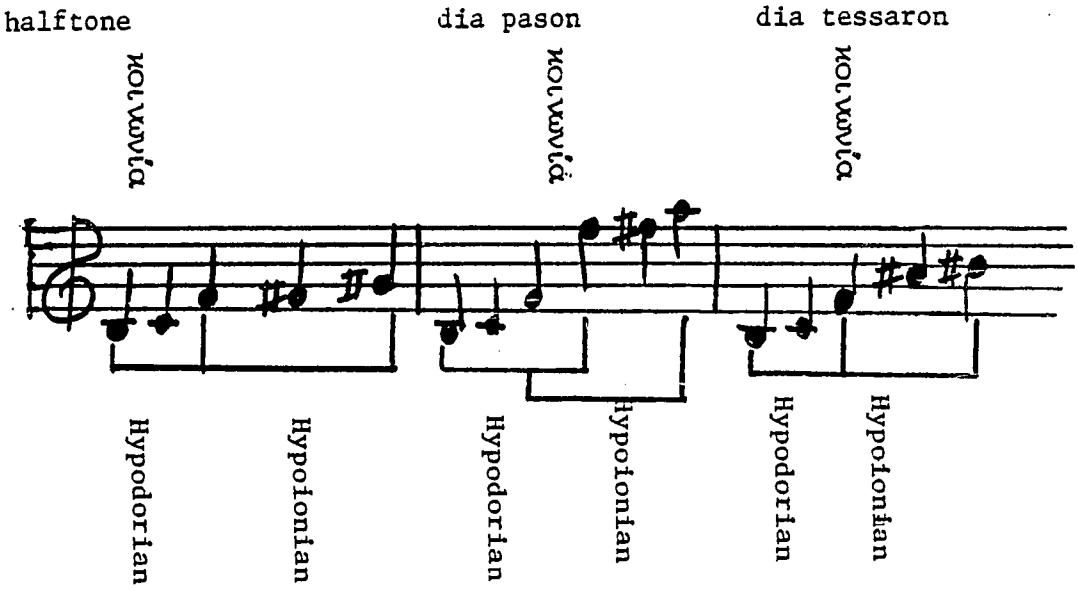
27.4 γένηται is one of the few subjunctives in the treatise. The others are found at 25.2, 25.4, 27.6, 27.9-10, 27.21, and 28.5. All are in ὅταν temporal clauses. The temporal clause with ὅταν plus subjunctive is Cleonides' way of suggesting the generality of application for generic modulation.

27.5 Again Cleonides disappoints his more eager readers. There are many different variations in systems, seven, in fact, which Cleonides outlined at 15.3-9. In discussing modulation by system, however, Cleonides refers only to systems differing in conjunction (συναφή) and disjunction (διάζευξις). Modulation by system occurs when a conjunct system modulates into a disjunct system of vice versa:

In general, Cleonides becomes less specific, informative, and expansive after the completion of his discussion on τόνος (26.18).

27.6 In discussing modulation by τόνος Cleonides first offers the expected statement which parallels his definition of modulation by genus and system: Modulation by τόνος occurs in moving from the Dorian into the Phrygian, or from the Phrygian into the Lydian or Hypermixolydian or Hypodorian, or from any of the thirteen τόνοι he mentioned at 25.7-26.8 into any of the remaining twelve.

27.10 Cleonides has finished discussing μεταβολὴ κατὰ τόνον. Now he speaks about emmelic (melodic) and ekmelic (unmelodic) modulations. He uses the examples of a halftone, whole tone, and so forth up to modulation by a dia pason, and he seems to mean that genera, systems, and τόνοι can modulate in this way. The closest relationship one τόνος can have with another is a hafltone; the largest is a dia pason. The Hypodorian, for instance, could modulate with the Hypoionian by a halftone, or by a dia pason, or by a dia tessaron:

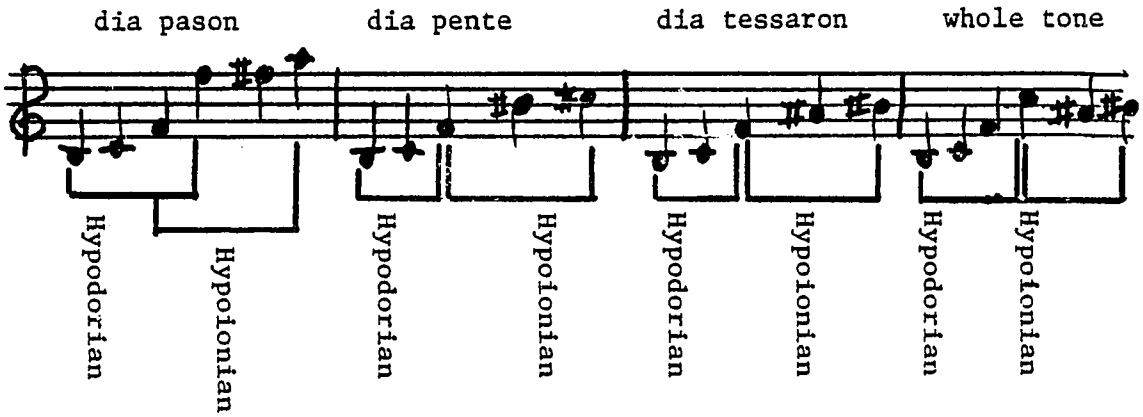


Some of these modulations occur by consonant, some by dissonant intervals. The dia pason and dia tessaron are both consonant (σύμφωνα) intervals; the halftone is a dissonant (διάφωνον) interval.

τῆς ἡμιτονίας is found in all the manuscripts, though Jan read ἡμιτονίου in Q (his B). An adjective ἡμιτόνιος, -α, -ον does not exist in our sources. If the feminine article is genuine, then Jan's

conjecture τῆς ἁρμονιαίας has merit. ἡμιτονιαίας is found nowhere else in Cleonides, but it can be found frequently in Aristoxenus, e.gg. 65.11, 19, Aristides, Ptolemy, and Bryennius. Jan's conjecture would be correct if Cleonides had wanted to make the adjective feminine to agree with an understood μεταβολῆς; but Cleonides is referring to intervals (τοῦ διὰ πασῶν at the end of the sentence; cf. 27.12: διαστήματα), not to modulations, i.e. τῆς διὰ πασῶν. Lastly, the archetype of MCP($M^1C^1P^1$) probably confused the abgreviation ᾱ(-ας) for ᾱ'(-ου).

27.13 Cleonides has just established that some modulation are consonant (σύμφωνα), others dissonant (διάφωνα). He now elaborates somewhat and qualifies the symphonic modulations. He adds to the modulations by symphonic intervals (dia tessaron, die pente, dia pason) modulations by the whole tone (ἡ τονιαία [μεταβολή]). The modulations he then labels ἐμμελεῖς ("melodic"). By definition the following modulations by τόνος are ἐμμελεῖς; by the dia pason, fifth, dia tessaron, or the whole tone:



For ἐμμελεῖς, see supra, 1.9, and parallels at Aristoxenus 14.5, 35.3-7, 46.13-16, 90.1-11, Bacchius #69, Ptolemy 1.4, 7, Porphyry ad loc., and Athen. 14/623 C.

27.14-15 Jan has ἄσσον in his text to create a doublet--ἄσσον ἐμμελεῖς ἧττον; he then saw the need to supply ἀπέχουσαι μᾶλλον as a doublet parallel with the ensuing αἱ δὲ μᾶλλον; ἄσσον ("nearer") forced the presences of ἀπέχουσαι ("at a distance, farther"). Jan seems to suggest in his apparatus that WNB have ἄσσον, but N omits all the words between μὲν αἱ (27.13) and ἐμμελεῖς, B (Vat. Barb. 265 (f. 300-310) omits the word ἄσσον, and W omits ἄσσον ἐμμελεῖς and ἢ; (Jan thought the abbreviated ἧττον was ἄσσον, but W's rough aspirate is very legible). ἄσσον has no manuscript support and should be omitted. Similarly, Jan's ἀπέχουσαι μᾶλλον now serves no purpose--it is parallel to nothing. The sentence still does not make perfect sense as it stands with the unnecessary corrections of M^1P^1: "Of the remaining modulations [i.e. those not by consonant intervals or by a whole tone], some are less melodic than unmelodic, others are more melodic." Bryennius has the same wording; Jonker (121) translates: "Some of them are more or less melodious than others." This text makes Cleonides' phrase quite awkward.

The musical sense should be clear. Some as yet unknown factor will make modulation seem to be in different melodic degrees ranging from melodic to unmelodic. This unknown factor Cleonides defines in the next sentences; it is κοινωνία. The more in common there is between the two modulated passages, the more melodic the modulation will be. This common factor does not apply to modulations executed at the three consonant intervals of the dia tessaron, dia pente, and dia pason or at

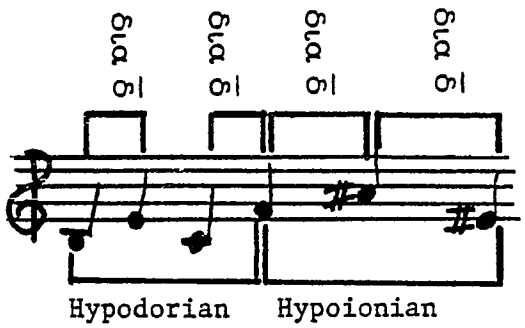
a whole tone; these are all ἐμμελεῖς by definition. Whereas one might otherwise try to label a modulation by a diaphonic interval a "dissonant" or "diaphonic" modulation, the Greeks had no such terminology. These "dissonant" modulations, that is, modulations by diaphonic intervals, ranged from melodic to unmelodic depending on the amount of κοινωνία. It would be completely superfluous, therefore, to call some modulation "less melodic than unmelodic, and other more melodic than unmelodic." It is much simper and clearer to say that some modulations are "less unmelodic, other more unmelodic." The text of P contains such a text and is printed here.

27.15 For ἐκμελεῖς, a rare word, see Ptolemy 1.7, Aristoxenus 46.6, 13, and Michaelides "Emmeles" 96.

27.16 MCP omit the second half of the sentence (ἐν ὅσαις δὲ ἐλάττων, ἐκμελέστεραι) while $M^1P^1C^2$ include it. M^1P^1 have just made the previous sentence excessively wordy, and they have probably done the same here; an explanation of ἐκμελής is found soon enough (at 28.2).

Jan adds εἰσιν after ἐμμελέστεραι with no apparent good reason.

27.18 Cleonides explains the sine qua non of his ἐμμελεῖς-ἐκμελεῖς discussion, averring that there is necessarily (ἀναγκαῖον) some common element present in every modulation. Modulation cannot happen between genera, systems, or τόνοι in any random way. There must be either a common note or a common interval; exactly which interval must be in common Cleonides does not make clear:



or a common system.

28.1 μετοχὴν means "sharing, participation." The word has technical meanings in astrology (Porphp. 1.90) and grammar (D.T. 634.5), but not in musicology. Cf. Bryennius 98.2, 120.22 (=Cleonides), and Aristides 10.8, 106.24, and 107.8.

28.2 The δὲ omitted by $M^{1}C$ is quite desirable in the parallel ὅταν δὲ...ὅταν γὰρ construction. M^{ac} again shows its weakness in this passage (cf. 27.11, 13f.) by reading the homophonic (or by attraction) ἐμμελεῖς for ἐμμελής. The singular is called for since ἐμμελής modifies μεταβολή (as does ἐμμελής (28.1)), not ἀνόμοιοι [φθόγγοι].

28.3 The fourth and final type of modulation is modulation by melodic composition (μελοποιία). Cleonides gives examples with the same format he employed in defining modulation by genus (27.3).

μελοποιία refers to musical composition (as opposed to musical performance) in Pl. Smp. 187 D, and cf. Rep. 404 D. In a technical sense, see Arist. Po. $1450^{b}16$, Pol. $1341^{b}24$, Philodemus Mus. 31 (Kemke). The verb μελοποιέω means "to make lyric poems" in Ar. Ra. 1328.

28.4 MCP read διαστανικοῦ; M^1 διαστηματικοῦ; and Lugdunensis Perizonianus F. 41 (not L (Jan)) διασταλτικοῦ. Both adjectives--διασταλτικοῦ and συσταλτικοῦ describe medical and musicological phenomena here, and they are clearly the correct forms. I have discussed these readings (as well as those in Aristides, Bryennius, and Ptolemy) in "The Diastaltic Ethos," forthcoming in Classical Philology.

28.6 Interestingly, Cleonides talks individually about the figures of the dia pason, the thirteen τόνοι, and the various ἤθη. Never does he connect any of the three. What modern scholars would have appreciated most is if Cleonides had given the musical properites of each ἦθος and the ethical quality of each τόνος or figure of the dia pason. The fact that he does not connect the three does not necessarily mean that there was no connection.

28.7 μεγαλοπρέπεια ("magnificence, especially of persons") is rarely found in the musicologists; see the parallels in Bryennius 122.4 and 364.1, Aristides 73.14, Bacchius #54, and [Arist.] 19.48.

δίαρμα originally meant "passage by sea" (Plb. 10.8.2) but Cleonides uses the word to mean "elevation," i.e. of style. Cf. [Longin.] 12.1 and D.L. 9.7, although Cleonides qualifies the word with the genitive ψυχῆς. ψυχή appears in the definition of each ἦθος (28.7, 11, 15).

28.8 In metrics one spoke of ἡρωϊκός as pertaining to "heroic verse, i.e. hexameter (Pl. Leg. 958 E). Cleonides does not suggest that the diastaltic ethos was used in performing Homeric epic, however, for he makes it quite clear that tragedy (28.10) was performed

in this ethos. On the other hand, τῶν λοιπῶν ὅσα τούτου ἔχεται τοῦ χαρακτῆρος does not necessarily eliminate the possibility of epic's applicability.

πάθος means "that which happens," but it can suggest either a good or bad experience. The philosophers use it in connection with the soul (as does Cleonides here); in this case πάθος can be translated as "emotion, passion" (LSJ II), or as "properties, qualities." Cleonides' πάθη means the properties of the soul. See also Michaelides "Pathos" 243-44.

28.11 ταπεινότης means "lowness" of position when referring to a place, "lowness" of condition when referring to people. In conjunction with συσταλτικός ("depressing"), ταπεινότης means "depression" or "dejection."

28.12 διάθεσις has several technical meanings. In oratory it refers to "delivery," in law to "disposition" (of property, Lys. Fr. 44), in grammar to a verb's "voice." The word generally refers to any "order or "arrrangement"; cf. τίθημι. But philosophy used the word to specify "bodily state or condition," the meaning which Cleonides uses here.

ἄνανδρον serves virtually as an antonym to the ἡρωϊκός of the διασταλτικὸς ἦθος.

28.13 ἐρωτικοῖς was made into a clinical word by philosophers when it referred to love; cf. Pl. Phaedr. 227 C. Cleonides is not referring to a musical genre here (as he could be with θρῆνος and οἶκτος), but to a human condition.

θρήνοις does not necessarily refer to a musical genre any

more than does our English word "lamentation" (Pi. P. 12.8, Pl. Rep. 398 D). Sophocles (El. 88) speaks of "songs of lamentation" (θρήνων ᾠδάς) suggesting this non-technical use of the word. Pindar, of course, wrote a collection of θρῆνοι, but the title could be as late as Stobaeus (4.39.6). In conjunction with πάθεσι and οἴκτοις, θρήνοις for Cleonides probably does not refer to a musical genre.

οἶκτος ("wailing") does not necessarily refer to a musical genre either. That Cleonides seems to parallel τραγῳδία (28.9) and ὕμνοι, παιᾶνες, ἐγκώμια, συμβουλαί (28.16-17) with these non-genres is disturbing. Perhaps θρῆνοι and οἶκτοι can be musical genres--for οἶκτος, cf. Simon. 4.3 and Aesch. Ch. 411--while ἐρωτικοῖς πάθεσι would refer to a collection of genres all of which can portray an amorous ethos, e.g. the poems of Sappho.

28.15 ἡρεμότης is a hapax.

ἐλευθέριος originally referred to "acting like a free man," and then it was extended to mean "liberal, free-giving, frank." Cleonides' sentence necessitates a slightly different meaning, "free (from) care)." Aristotle (HA $488^{b}16$) uses ἐλευθέριος to mean "free-spirited," but this is in reference to a lion. In conjunction with ἡρεμότης and εἰρηνικόν the word must have some connotation of "tranquility."

28.16 εἰρηνικόν, a philosophical term, refers to political, not psychological "peace"; this explains Cleonides' use of ἐλευθέριος as being "free" in peace time, for peace time allows for individual tranquility (ἡρεμότης ψυχῆς). Such an atmosphere is conducive to hymns, paeans, and the like.

ὕμνοι, cf. 24.12, are songs in praise of gods. In Rep. 607

A Plato joins ὕμνοι with ἐγκωμία, as does Cleonides. Various kinds of ὕμνοι are listed in Men. Rh. 333 (Spengel). ἐγκώμιον is a laudatory ode sung in a village (κώμη), and it usually honors a local hero. It is directed more toward living men than are ὕμνοι. It differed from an ἐπινίκιον in that the ἐγκώμιον was sung by the komos in procession, the ἐπινίκιον by a (professional) chorus in a temple.

28.17 παιᾶνες were choral songs addressed to Apollo or Artemis, particularly in praise for deliverance from misfortune. Occasionally the recipient of a paean was not a child of Leto, e.g. Poseidon (X. HG 4.7.4)

συμβουλαί refer to political counsels or advice. There is no apparent connection to music, let alone to a type of musical genre. They would take place more frequently in peace time (ἐλευθέριόν τε καὶ εἰρηνικόν), but why does Cleonides refer to them amidst three other well-known musical genres--hymns, paeans, and enkomia?

28.19 Cleonides now discusses the seventh and final topic, μελοποιία. When he mentioned μεταβολὴ κατὰ μελοποιίαν earlier, Cleonides used the term only as a general category which embraced the three general types of ethos--diastaltic, systaltic, and hesychastic. In this passage on μελοποιία proper Cleonides now has quite a different type of μελοποιία to present. He makes no mention of ethos, but of four kinds of μελοποιία which describe various uses of notes--ἀγωγή, πλοκή, πεττεία, and τονή.

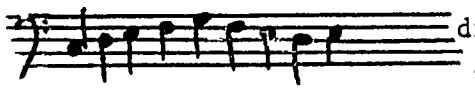
μελοποιία is the logical culmination of the rest of the parts of harmonics presented in this treatise. It employs all the notes, intervals, genera, systems, τόνοι, and modulations which have

been discussed in detail. "Melodic composition" needs more than just notes, systems, and modulations, however; it needs a melody and melodic form. Neither Cleonides nor any Greek musicologist tells his reader how to write a melody or gives an example of one. But Cleonides does tell his reader the four ways in which a melody can be shaped in the next sentence.

For μελοποιία in general, see supra, 2.8f., which is slightly different; Aristoxenus 48.4-18; Aristides 28.10-31.2; Anonymous Bellermann #2; Bryennius 360.19-364.9; Martianus Capella #936, 965; (Arist. Pol. 1341^{b}); Bacchius #77, 88; Gaudentius 327.7; Alypius #2; and also T. Trinkler, Die Lehren von der Harmonik und Melopöie der griechischen Musik in ihren Grundzügen dargestellt (Posen 1842).

29.2 μὲν οὖν again begins the first sentence of a multi-part discussion. The ἡ is necessary to clarify what modifies ὅδος; MC are incorrect in omitting it.

ἀγωγή ("succession, scalar progression") describes a melody which proceeds through consecutive notes;

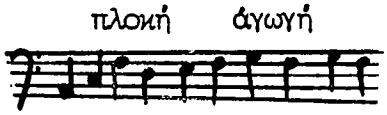


For musicological and rhythmical parallels in addition to those mentioned above, see Bacchius #50, 56, [Ptolemy] #14-51, Martianus Capella #970, and Bryennius 322.1f.

ὅδος, other than its common meanings, can signify "method" or "system" (Pl. Sph. 218 D). Cleonides possibly uses ὅδος in this sense, but "progression" seems more appropriate. ὅδος in this sense

is apparently strictly a musicological term, for it is used by Cleonides and Aristoxenus (83.7) alone.

πλοκή ("weaving") is the side by side location of alternate (non-consecutive) intervals, that is, a succession of non-consecutive notes:

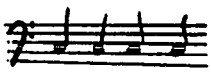


Generally, πλοκή meant almost any kind of "weaving" or "twisting," be it a web (Eur. IT 817), a part of the human body (Galen UP 1.9), or a dramatic plot (Arist. Po. 1456^{a}9). Martianus Capella (#958) uses the word in opposition to ἀγωγή. LSJ is incorrect in defining it only as "harmony."

For παράλληλος, see supra, n. 26.12. ἐναλλάξ serves as the opposite to ἐξῆς in the definition of ἀγωγή.

29.4 The τε added by MCP is lightly awkward, for it forces ἐναλλάξ and παράλληλος to be conjoined; yet their word order argues against this.

πεττεία describes the repetition of a note.



Cleonides here uses τόνος to equal φθόγγος; cf. 24.5f.

29.5 C has γινομένου for γινομένη; but it is the playing (πλῆξις) which "occurs" repeatedly, not the note (τόνος).

τονή is the temporal prolongation of one note. The phraseology of this definition at first seems crude. But if Cleonides had

said simply τονὴ δὲ ἡ ἐπὶ πλείονα χρόνον μονὴ ἑνὸς τόνου γενομένη, he would not have made it clear that the note was to be held when played only once (κατὰ μιὰν γενομένη προφορὰν τῆς φωνῆς). Otherwise, the melodic construction would have the same effect as πεττεία.

τονή is not found outside of musicology; it is discusses only here and at Bryennius 360.27 and 362.8. The two examples of τονή in Bryennius, however, have the variant (and more common word) μονή in several manuscripts. μονή has a meaning somewhat similar to that of Cleonides' τονή at Aristoxenus 17.3 and Aristides 6.27 and even more so at Bacchius #45: Μονὴ δὲ τί ἐστιν; Ὅταν ἐπὶ τοῦ αὐτοῦ φθόγγου πλείονες λέξεις μελῳδῶνται. It is doubtful that Bryennius originally wrote μονή since his primary source here is Cleonides and no (extant) Cleonides manuscript reads μονή for τονή. Moreover, Bryennius and Cleonides both use the word μονή to define τονή. It is therefore also doubtful that Cleonides could have actually written μονή for τονή. There is no reason to doubt the validity of τονή as a musicological term; in fact, it is still another musicological term derived from τείνω. τονή is not included by Aristides (29.8) even though he discusses ἀγωγή, πλοκή, and πεττεία.

μιὰν προφορὰν means "one utterance." προφορά was used commonly by post-classical Greek authors in a verbal, not musical sense. Only Cleonides, Bryennius (=Cleonides), and Gaudentius (#8) use the word in a musical sense.

χρόνος is the only reference to rhythmics in Cleonides' treatise, and even here he does not seem to use the word in its highly technical meaning of "a unit of time." Cf. Bacchius 313, Aristoxenus Rhythm. 3, Anonymous Bellermann #1, 3, and Aristides

passim.

29.7 After φωνῆς Q adds as an insert Aristides' discussion of μελοποιία (28.10-30.17). This passage includes the reading omitted in Winnington-Ingram (C1); see there p. 28 (apparatus). Q does not include any more of the Εἰσαγωγὴ ἁρμονική, but ends here (or rather after the Aristides insert (διορθοῦτο (30.17)). Several members of the Q family therefore insert summarizing charts of the tones, notes, intervals, and shades here.

29.8-29.15 Jan correctly brackets 29.8-29.15; and though most of the manuscripts preserve the passage, they do so only after interruptions. Q alone ends entirely its transmission of the treatise at 29.7, but this demarcation is perhaps clouded by a massive insert from Aristides at that point. M adds a title, Εἰσαγωγὴ ἁρμονικὴ Εὐκλείδου before δύναμις at 29.10, and MCP(U) give a capital delta to this δύναμις. (Neapolitanus gr. 260 (f. 55-64) treats this division just as did other manuscripts at other divisions, e.gg. 1.9 and 24.6, with a title Περὶ δυνάμεως. Vat. 1033 omits the entire treatise until this δύναμις at 29.10 and then introduces this passage with the title Εἰσαγωγὴ ἁρμονικὴ Εὐκλείδου).

The text of the passage is superfluous, disorganized, uninformative, and repetitious. One might well wonder what significance the perfunctory definition of διάγραμμα has at the conclusion of a treatise on harmonics if there are no diagrams to follow. To what is the δύναμις relevant here? And why is μελοποιία defined for a third time? There are possible explanations. Cleonides has become quite laconic in these last pages, unwilling for the most part to clarify

anything as extensively as he would have in the earlier two-thirds of the treatise; cf. his vague and brief treatment of μελοποιία. Perhaps he did not take as much care in writing these final sentences. Perhaps his sources were scanty. Perhaps while preserving the end of Cleonides' treatise the manuscript tradition did not do so without error; omissions or interpolations may have occurred as well as epitomizing.

By far the most cogent reason for not attributing these lines to Cleonides is their lack of cohesiveness and connection with the rest of the treatise, the first and last words of which are ἁρμονική and τὸ ἡρμοσμένον. Cleonides announced in 1.6f. everything he intended to discuss in the work, and with the conclusion of the μελοποιία discussion (29.7) he has done so. All there is left to write is the peripatetic sign-off, and this is accomplished in 29.16-17. Of the three definitions given in this spurious passage, only that of διάγραμμα is at all useful, and yet it applies to nothing in particular in the rest of the treatise (or in the μελοποιία discussion immediately preceding). The definition of δύναμις must be rejected on two accounts. δύναμις was already mentioned at 3.10, 23.19, and 28.20, and if Cleonides did not feel compelled to define the term in any of these three discussions, he would not do so here. The only reason the definition of δύναμις is found here is because of its presence in the (also spurious) definition of διάγραμμα just preceding. Second, Cleonides does not offer alternative definitions of terms. Bryennius does because he follows several incompatible sources, but Cleonides is dogmatic and succinct and unified. The two definitions of δύναμις given here are essentially the same, whence the partial deletion by S. Finally, μελοποιία has al-

ready been defined by Cleonides at 2.8 and discussed--if briefly--at 28.19-29.7. In his discussion of μελοποιΐα, Cleonides gave a second definition of the term, the terminology of which definition differs slightly from the first definition of the word given already at 2.8f. It is most unlikely that after finishing his discussion of μελοποιΐα and then adding unrelated definitions of διάγραμμα and δύναμις, that Cleonides would then offer another, a third, definition of μελοποιΐα, and with the same wording as the first.

29.8 Only Bacchius (#62) defines this term διάγραμμα; apparently it was not part of the regular musicological terminology. Perhaps its presence here has something to do with the diagrams found in N and Vat. 1346.

29.10 δύναμις was already mentioned by Cleonides in naming the eighteen notes (3.10), in defining simple and complex systems (23.19), in describing μελοποιΐα (28.20), and again in defining διάγραμμα (29.9). The "function" of a note differs from the location of a note; cf. supra, 23.16.

29.16 The word ὅρος had many meanings all derived from the basic meaning of "boundary, landmark." Aristotle (Top. $101^{b}39$) used it as a "definition," but Cleonides seems to use the term here as the "limit" of the study of harmonics, not the "definition" of the study of harmonics. Anonymous Bellermann (#12) uses ὅρος to mean "definition," but cf. Pl. Phlb. 17 D and Rep. 443 D. Aristoxenus, e.g. 74.13, uses the term as the "limit" of intervals. Bryennius has a variety of uses, none parallel to or derived from Cleonides'. The same is true for the

following passages: [Arist.] 19.35; Nicomachus #8 and p. 261.16, 276.5; Bacchius #65; Gaudentius #1; [Ptolemy] #1, 24; and Aristides 14.6, 81.20, et al.

It is not unique to announce the ending of an harmonic discussion. Cf. Aristides 31.1f.: ὁ μὲν οὖν ἁρμονικὸς τῆς μουσικῆς τρόπος ἀρκούντως ἂν ἡμῖν ἔχοι· μεταβῶμεν δὲ λοιπὸν ἐπὶ τὴν ῥυθμικὴν θεωρίαν; Martianus Capella #966: Haec de septem partibus artis nostrae sufficiat; and Bryennius 374.27f: ἁπλῶς μὲν οὖν εἰπεῖν τοιαύτη τίς ἐστιν ἡ ἁρμονικὴ κληθεῖσα ἐπιστήμη, οἵαν διεληλύθαμεν. There is little doubt that this sentence is genuine and belongs with the rest of the treatise (after 29.7).

κατὰ τὸ ἡρμοσμένον is unique, but cf. Aristoxenus 44.4f. (περὶ), 24.18f. (εἰς), Bryennius 68.19, 306.31, and 358.11 (all περὶ).

After πραγματείας, U places the title of the treatise, Εὐκλείδου εἰσαγωγὴ ἁρμονική. C has the title Περὶ φθόγγων, which refers to the beginning of the ensuing Sectio Canonis.

GUIDE TO THE COMMENTARY:

The major musicological discussions and general exegesis to be found in this commentary are concentrated in the following passages:

1.2	title of the treatise
1.11	parallel definitions of διάστημα
2.1	parallel definitions of γένος
2.2	parallel definitions of σύστημα
2.4	parallel definitions of τόνος
2.6	parallel definitions of μεταβολή
2.8	parallel definitions of μελοποιία
2.11	acoustics
3.3-3.7	acoustics and notes
3.12	arrangement of the three genera; adjectival forms
4.22	diagramming Greek music; the diatonic genus
5.19	the chromatic genus
6.1	the enharmonic genus; confusion in listing the notes
6.11	mixed genera
7.16	fixed and movable notes
8.1	apyknoi and barypyknoi
8.8	mesopyknoi and oxypyknoi
8.22	the diatonic as "pyknoi"
9.3	intervals
9.12	consonant and dissonant intervals
9.18	tritone, tetratone, pentatone; textual criticism
10.3	composite and non-composite intervals

11.2	rational and irrational intervals
11.9	genus
11.21	locus of the lichanos
12.6	shades
13.5, 7	etymology of the shades
14.12	numerical symbols for the shades
15.3, 9	systems
15.14	consonance and dissonance
16.20	hypothetical "conjunct" consonances
17.2	dissonant systems
17.4f	figures of the consonant systems
19.4	τόνοι
21.11	conjunct and disjunct systems
22.3	νητῶν tetrachords
22.10	perfect sytems
23.8	the ametabolic system
23.16	mese κατὰ θέσιν
24.6	τόνοι
24.14	the Ion fragment
25.4	τόνοι vs. the octave figures
25.7	Cleonides' τόνοι
26.19	modulation
27.10f.	melodic and unmelodic modulation
28.19	melodic composition
29.8	the interpolations and the end of the treatise?

APPENDIX: THE EUCLIDEAN ATTRIBUTION OF THE SECTIO CANONIS

While Jan and the others are most likely correct in proposing that Euclid did not write the Εἰσαγωγὴ ἁρμονική, they could be correct for the wrong reason. It must be true that Euclid could not have written both this treatise and the Sectio Canonis; the elements of mathematics and harmonics have led scholars to this irrefragable decision. But there is a question as to whether Euclid wrote the Sectio Canonis; in fact, several codices, including the twelfth-century C, attribute the Sectio Canonis to Cleonides.

Menge (VIII xxxvii-xlii) in his edition of the complete corpus of Euclidean writings argues against Euclidean authorship of the Sectio Canonis. His argument is based on the testimonia for an Euclidean musicological work, which testimonia is found first in Proclus, Marinus, and Theodorus Metochita. Proclus (Commentary on Euclid's Elements 1.69.3)[1] states that Euclid wrote an introductory musical work entitled αἱ κατὰ μουσικὴν στοιχειώσεις. Marinus (Commentary to Euclid's Data 6.254.19) simplifies the title slightly--μουσικῆς στοιχεῖα. This variance in titles means little.[2] Theodorus Metochita[3] says that Εὐκλείδης καὶ μουσικῶν ἅπτεται...ἐπισκέψεων.

It seems certain that Euclid wrote an "Elements of Music," but was this the Sectio Canonis, the Εἰσαγωγὴ ἁρμονική, or some lost work(s)? It has already been shown that the Euclid who was a famed geometrician, intellectual disciple of Pythagoras, Theaetetus, and Ar-

chytas, could not have written the Εἰσαγωγὴ ἁρμονική.[4] One cannot ignore the numerous stylistic, methodological, verbal, and musicological parallels between this treatise and the collective musicological treatise by Aristoxenus.[5] Second, Euclid and Aristoxenus were contemporaries, and it would have been most awkward for Euclid to have written the Εἰσαγωγὴ ἁρμονική and within it to have cited (25.6) the authority of his rival Aristoxenus. Lastly, no treatise with the title Εἰσαγωγή is known to have been written before the first century B.C.

Jan and Menge tried to reconcile the information from Proclus and the extant treatises. Proclus and Marinus describe Euclid's musicological work as Στοιχεῖα, and this word implies a major, comprehensive work. Jan (118-19) thinks some of this comprehensive work has been lost, and that Euclid actually had written two musicological works, citing Proclus' plural στοιχειώσεις as evidence. Jan hypothesizes that notes and consonances were treated in one musicological work, and that the Sectio Canonis was a different work--the culmination of and extraction from the earlier large work. Jan could be correct, of course, but στοιχειώσεις could refer to the general "elements" (cf. the geometical Στοιχεῖα) of musicology as easily as to several "elementary books" on the subject. On the other hand, Proclus also wrote a Στοιχειώσις θεολογική and a Στοιχειώσις φυσική which employ the singular form of the word. Menge argues in reply that Euclid would not have extracted material from one work to publish it as a separate unit; this procedure would conflict with Euclid's everpresent methodology--to begin with basics and then proceed in order to the more elaborate contructs.

Jan (115) had also argues that the methodology and phraseology are clearly Euclid's: "Idem profecto est genus cogitandi in hac

canonis musici libello et in geometriae elementis. eadem prorsus est dictio et demonstratio, qua orsus ab ἔστω et ὑποκείσθω auctor procedit per φημὶ δή, per ὁ α, ὁ β, ut perveniat ad ὅρα illud conclusionis et ὅπερ ἔδει δεῖξαι. Similarly, Jan compares the mathematics of Euclid's Elements with the geometry of the Sectio Canonis. He mentions that Euclid transfers numbers or sounds to line and lengths in Elements 5 and 7.

Books 5 and 7 of the Elements do treat proportions, and all Pythagorean musical physics are based on proportions. But Elements 5 and 7 discuss only multiple proportions, and in music multiple proportions account only for the octave (2:1), twelfth (3:1), and double octave (4:1). Euclid in the Elements makes absolutely no mention of these musical applications, however, nor does he even mention the more common musical proportions, e.g. the ἡμιόλιον (3:2) or ἐπίτριτος (4:3) or the ἐπόγδοος (9:8). The only use Elements 5 and 7 have for the reader of the Sectio Canonis is the theorem (5.12): "If any number of magnitudes be proportional, as one of the antecedents is to one of the consequents, so will all the antecedents be to all the consequents." This theorem can be applied to Sectio Canonis pr. 2 (β): Ἐὰν διάστημα δὶς συντεθὲν τὸ ὅλον ποιῇ πολλαπλάσιον, καὶ αὐτὸ ἔσται πολλαπλάσιον, and to several other proofs (pr. 4, 5, and 6).[6] But most of the proofs in the Sectio Canonis concern superparticular relationships, and Euclid makes no mention of these in Elements 5. The only connection between books 5 and 7 (and 8) of the Elements is the general idea that lines in proportion to another line which is in proportion will also be in proportion to any line which is in proportion with that other line. In all thirteen books of the Elements, in fact, the words ἐπιμόριος, ἐπί-

τριτος, and ἐπόγδοος, which describe the proportions n + 1:n, 4:3, and 9:8, respectively, and which fill the pages of the Sectio Canonis, never appear.

Lastly, perhaps the last part of Jan's argument is the most important, for he cites (116) Porphyry (Düring 92.29-30) as evidence of Euclidean authorship for the Sectio Canonis. Since Porphyry's late third-century A.D. date is descure, one can at least assert that the terminus ante quem for the attribution of the Sectio Canonis to Euclid is c. 275 A.D., and this early date strongly suggests Euclidean authorship. On the other hand, 275 A.D. is still six centuries later than Euclid's lifetime.[7]

NOTES

1 See William Barret Frankland, The First Book of Euclid's Elements (Cambridge 1905); Paul Ver Eecke, trans., Les commentaires sur le premier livre des éléments d'Euclide (Bruges 1948); and G. Friedlein, Procli Diadochi in primum Euclidis Elementorum librum Commentarii (Leipzig 1873).

2 In the manuscripts the Εἰσαγωγὴ ἁρμονική is labeled variously Εἰσαγωγὴ ἁρμονική, Εἰσαγωγὴ ἁρμονικῆς πραγματείας, and Περὶ ἁρμονικίας.

3 M. C. G. Müller and M. T. Kiessling, Θεοδώρου...Ὑπομνηματισμοὶ καὶ σημειώσεις γναμικαί (Leipzig 1821) 108.

4 Menge (xxxviii) summarizes this opinion: "Cum auctor eius sit Aristoxenius, Euclides vero Pythagoreus."

5 The extant three books by Aristoxenus probably consist of various parts and transformations of both the Ἀρχαι and the Στοιχεῖα.

6 Cf. also Elements 7.12 and 8.7, and T. L. Heath, The Thirteen Books of Euclid's Elements^2 (New York 1956) 295.

7 Heiberg (Litt. Studien 35f.) cited Proclus to show that the technique used in the Sectio Canonis was the universal method of demonstration, not a method used singularly by Euclid. Moreover, Jan exaggerated, for λέγω and φημί are absent in propositions 11-20. Paul Tannery, "Inauthenticité de la 'Division du Canon' attribuée à Euclide," CRAI (1904) 439-45, argues that the last two propositions of the Sectio Canonis treat the diatonic genus while the previous propositions treat the enharmonic. Since the diatonic genus was more popular at a later date than the enharmonic, Tannery concludes that propositions 19 and 20 were written at a later date than the first eighteen propositions; Tannery ascribes propositions 1-18 to Euclid and propositions 19-20 to Eratosthenes. Charles-Émile Ruelle, "Sur l'authenticité probable de la Division du Canon musical attribuée à Euclide," REG 19 (1906) 318-20, retorted that the enharmonic and chromatic and diatonic genera could all be treated at the same period in Greek history. Menge (xlii) ultimately concludes that the Sectio Canonis is an extract from a Euclidean work by a less than brilliant man ("quod nomen suum titulo non addidit, nemo erit qui mirabitur), and Menge here does not differ greatly from Jan who proposed that Euclid extracted his own work.

For other discussions, see I. Düring, Ptolemaios und Porphyrios uber die Musik (Göteborg 1934) 177; W. R. Knorr, The Evolution of the Euclidean Elements (Dordecht/Boston 1975) 211-25, 231, 245-49; James Gow, A Short History of Greek Mathematics (New York 1884) 214; F. Hultsch, "Eukleides" RE VI 1050-1051; and Julius Caesar, Die Grundzüge der griechischen Rhythmik (Marburg 1861) 27f.

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